A theory-based investigation of patient and healthcare professional behaviours linked to optimal removal of short-term urinary catheters

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Abstract

Catheter-associated urinary tract infections (CAUTIs) are among the most prevalent healthcare-acquired infections. Prolonged catheter duration increases CAUTI risk by 5% per day. The average duration of postoperative short-term urinary catheterisation in the UK remains higher than recommended standards. Implementation of early catheter removal guidance is likely influenced by patient and healthcare professional (HCP) factors. This research investigates behavioural determinants (barriers and enablers) of prolonged catheter duration using the theoretical domains framework (TDF).

Study 1 (literature review) highlighted that existing interventions and current guidance on catheter removal focus on either limiting the use of urinary catheters or on early catheter removal. A combination of strategies appears more effective than a singular strategy, but sustained improvement over time remains unclear. Current UK guidelines on the timing of catheter removal were non-specific. Two TDF-based interview studies explored barriers and enablers to prolonged catheter duration with hospital-based HCPs (doctors, nurses and ancillary staff) (Study 2) and with hospitalised/catheterised patients (Study 3).

For HCPs, several key barriers to catheter removal practice were identified, for example, low motivation to remove catheters promptly due to competing demands; poor knowledge of removal guidance and evidence-based practice. Key enablers for HCPs included being highly skilled at removing catheters; the use of handover notes, reminders and daily task lists; and having senior and specialised colleagues as role models. Patient barriers to engaging with HCPs were, for example, perceived inability to manage without a catheter/dependence on the catheter, environmental and resource factors such as the lack of accessible toilets and staff assistance with toileting, staff attitudes, and ward culture. Patient enablers were: motivation to engage to speed-up hospital discharge and social support from the family.

A range of modifiable barriers linked to HCP and patient-related behaviours were identified which may help explain the prolonged duration of short-term urinary catheters. A behaviour change intervention targeting these barriers whilst strengthening the enablers may reduce catheter duration and subsequently CAUTIs.

Dedications

In memory of my dad who always encouraged me to do my best and persevere. I have done my best dad and I hope I have made you proud. Memories of you will always be in my heart.

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Statement of contributions

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Chapter two: RBG undertook the work for this chapter, and JP, SH, CH and FS provided comments.

Chapter three: RBG, RP, JP and DCS devised the study. EG and FB provided expert advice on composing literature review search strategy. RBG led the database searches, literature screening, quality appraisal and collation of results. RBG drafted the chapter and JP, SH, CH and FS provided comments.

Chapter four: RBG, RP and JP designed the study. RBG conducted the interviews and led the analysis, supported by SMc and SG. RBG produced the draft and JP, SH, CH and FS provided comments.

Chapter five: RBG, RP and JP designed the study. RBG conducted the interviews and led the analysis, supported by SMc and SG. RBG produced the draft and JP, SH, CH and FS provided comments.

Chapter six: RBG wrote thesis discussion chapter, and JP, SH, CH and FS provided comments.

Thesis Outputs

Throughout the course of this research I have produced a number of related outputs to date. These are summarised below.

Published abstracts

- **Bhardwaj-Gosling, R**., Sniehotta, F.F., Hrisos, S., Harding, C., Potthoff, S, Abley, C., Presseau, J., (2018) *Barriers/enablers to implementing guidance: a theory-based study, investigating healthcare-professional behaviours around prompt urinary catheter removal*: 32nd European Healthy Psychology Society Conference, podium presentation, Galway, Ireland.

- **Bhardwaj-Gosling, R**., Sniehotta, F.F., Hrisos, S., Harding, C., Potthoff, S, Abley, C., Presseau, J., (2018) *Patient engagement and communication behaviours around prompt urinary catheter removal: a prospective theory-based correlational study*: 32nd European Healthy Psychology Society Conference, interactive poster presentation, Galway, Ireland.

- **Bhardwaj, R**. Pickard, R., Carrick-Sen. D., Presseau, J. (2013) *Reducing the duration of urinary catheters: A protocol for interview study with patients and healthcare professionals using theoretical domains framework*. Interactive poster presentation at the 9th UK Society of Behavioural Medicine, Oxford, UK.

Conference presentations

- **Bhardwaj-Gosling, R**., Michell, P. (Co-presentation with REDUCE project PPIE panel member), (2017) "*Innovative ways of involving PPI on research projects".* **Winner: Best Oral Presentation**. NIHR School for Primary Care Research, PPI Themed Conference 'Developing Skills in PPI', Royal Station Hotel, Newcastle, UK.

- **Bhardwaj-Gosling, R**. (2017) *REDUCE: Reducing the duration of urinary catheters and associated infections*. North East Postgraduate Research Conference, oral presentation, Newcastle, UK.

- **Bhardwaj, R**. Pickard, R., Presseau, J. (2014) *Mixed methods study of reducing the duration of short-term urinary catheters: preliminary findings of the qualitative phase*. Canadian Knowledge Translation Annual Scientific Meeting, Interactive poster presentation, Quebec City, Canada.

Invited presentations

- **Bhardwaj-Gosling, R**. (Jan 2018): *Urological Morbidity Associated with Catheter Infections*. Invited speaker at Regional Urology Research Collaborative with Ageing Focus, Newcastle.

- **Bhardwaj-Gosling, R**. (Mar 2018): *The impact of Catheter Infections on Elderly Patients*. Invited speaker at Academic Geriatrics Annual Meeting, Newcastle.

- **Bhardwaj, R**. (Oct 2016): *REDUCE Project: Preliminary findings of qualitative interviews*, City University, London.

- **Bhardwaj, R**. (June 2014): *Challenges to Patient Engagement in Reducing Urinary Catheter Duration and Associated Infections*. Invited speaker at Laval University, hosted by Professor France Légaré (Canada Research Chair in the Implementation of Shared Decision Making), Quebec City, Canada.

Abbreviations

AMR: Antimicrobial Resistance

ANTT: Aseptic Non-Touch Technique

BCTs: Behaviour Change Techniques

BMC: BioMed Central

CAUTIs: Catheter Associated Urinary Tract Infections

CCP: Catheter Care Plan

CCSG: Catheter Care Sub Group

CDC: Centers for Disease Prevention and Control

CFU: Colony-Forming Unit

CINAHL: Cumulative Index to Nursing and Allied Health Literature

CMO: Chief Medical Officer

COREQ: Consolidated Criteria for Reporting Qualitative Research

DMOC: Decision Making and Organisation of Care

DoH: Department of Health

EAU: European Association of Urology

E.Coli: *Escherichia Coli*

EPIC: Evidence-based Practice in Infection Control

EPOC: Effective Practice and Organisation of Care

ERAS: Enhanced Recovery Programme after Surgery

GCP: Good Clinical Practice

GPs: General Practitioners

HAIs: Healthcare Acquired Infections

HAPA: Health Action Process Approach

HCP: Healthcare Professional

HICPAC: Healthcare Infection Control Practices Advisory Committee

HPV: Human Papillomavirus

HSR: Health Service Research

IMRaD: Introduction, Methods, Results and Discussion

IMB: Information Motivation and Behavioural skills model

IPC: Infection Prevention and Control

MRC: Medical Research Council

NHS: National Health Service

NICE: National Institute for Care and Excellence

NIHR: National Institute for Health Research

NSR: National Surveillance Report

NuTH: Newcastle upon Tyne Hospitals NHS Foundation Trust

PDSA: Plan, Do, Study, Act

PHE: Public Health England

PIS: Participant Information Sheet

PTFE: Polytetrafluoroethylene catheter

QOL: Quality of Life

RCT: Randomised Controlled Trial

SCT: Social Cognitive Theory

SHEA: Society for Healthcare Epidemiology of America

SPC: Supra Pubic Catheter

SPCR: School of Primary Care Research

TACT-A: Target, Action, Context, Time, Actor

TDF: Theoretical Domains Framework

TPB: Theory of Planned Behaviour

TURP: Transurethral Resection of Prostate

TWOC: Trial without a Catheter

UTI: Urinary Tract Infection

WOC: Wound, Ostomy and Continence

Chapter 1. Introduction

1.1 Research context

Healthcare Acquired Infections (HAIs), also known as nosocomial infections, are a significant cause of morbidity and mortality and pose a high burden on healthcare systems worldwide (Centers for Disease Prevention and Control, 2015). HAIs can be caused by different types of pathogens of fungal, viral or bacterial origin (Klevens *et al.*, 2007). The common types of HAIs are bloodstream infections, ventilator-associated pneumonia, surgical site wound infections and Catheter-Associated Urinary Tract Infections (CAUTIs) (Khan *et al.*, 2017).

Over 2 million people admitted to UK National Health Service (NHS) hospitals are catheterised each year, making urinary catheters one of the most common sites of HAIs (Bjerklund Johansen *et al.*, 2007). As a result, there has been a recent upsurge of national and international initiatives to prevent and reduce CAUTI and avoid this preventable harm to patients. National surveillance reports (NSR) in England, conducted between 2010-2016, have shown bacteraemia rates to be on the rise by 24.3% due to *Escherichia Coli* (*E.coli*), a Gram-negative bacteria, which is responsible for 46.9% of symptomatic CAUTI/UTIs and asymptomatic bacteriuria, contributing to HAIs (Bou-Antoun *et al.*, 2016; Public Health England, 2015).

Commensurate with the rise in CAUTI/UTI incidence, the NSR noted an increase in antibiotic use as well as an increase in antimicrobial resistance (AMR); these two factors are likely related (Public Health England, 2015). In response, NHS England charged clinical commissioning groups with reducing the number of Gram-negative infections by half by 2021 with an initial focus on reducing *E. coli* bacteraemia through the implementation of care quality improvement initiatives nationally (UK AMR Strategy High Level Steering Group, 2015). Despite the government's efforts, Gram-negative infections continue to rise. From 43,200 cases overall, there was a 5% increase in *E. coli* infections compared between 2018 and 2019 figures and 7% in community-onset infections (Serle, 2019).

Prolonged catheter duration is one of the main factors contributing to the increased risk of developing bacteria in urine (bacteriuria) by 5% per day (Gokula *et al.*, 2004; Loveday *et al.*, 2014; Fukuoka *et al.*, 2018). Over time, with the presence of bacteriuria, a bacterial biofilm starts to form on the surface of the catheter tube which is responsible for symptomatic and

asymptomatic bacteriuria (Trautner and Darouiche, 2004; Sabir *et al.*, 2017). Minimising duration of catheterisation is an effective method of reducing CAUTI but early catheter removal requires a change in the standard practice.

Despite current initiatives and abundant existing interventions (described in the literature review in chapter three), catheter duration remains longer than the recommended international standard. CAUTI continues to be one of the main HAIs posing disease and financial burden on patients and healthcare systems (Saint *et al.*, 2009). The findings of a large national randomised controlled trial (RCT) and a cross-sectional audit conducted locally at the Newcastle upon Tyne Hospitals Foundation Trust (NuTH) showed a median duration of postoperative urinary catheterisation of 3 days compared with the recommended standard of 1-day (Bhardwaj *et al.*, 2010; Gould *et al.*, 2010). Successful implementation of a policy of early catheter removal is likely to be affected by several factors related to both healthcare professionals (HCPs) and patient-related behavioural factors (Saint *et al.*, 2016; Bhardwaj *et al.*, 2012). Any initiative to reduce catheter duration, therefore, requires patient and HCP behaviour change to alter current practice.

1.2 Research rationale

Two effective ways to combat CAUTI are, firstly, to avoid the entry of bacteria at the time of catheter insertion by following a strict Aseptic Non-Touch Technique (ANTT) (Rowley *et al.*, 2012) and, secondly, to ensure prompt removal of the catheter (Meddings *et al.*, 2014). Training and monitoring aspects of aseptic catheter insertion have helped reduce the risk of CAUTI (Lo *et al.*, 2014) but the reduction in catheter duration has proved harder to implement and involves a change in standard practice (Niël-Weise and van den Broek, 2005). To date, existing research and interventions do not provide sufficient insight into factors that may be driving delayed catheter removal. There is a lack of a detailed and comprehensive investigation in the literature on reasons for delays in catheter removal from a healthcare provider (i.e. an HCP) and receiver's (i.e. a patient) perspectives. This evidence gap has also been highlighted in a recent Public Health England (PHE) report on a strategic behavioural analysis of interventions on reducing CAUTI (Atkins *et al.*, 2019 (In preparation)).

The purpose of the research conducted and reported in this thesis was to identify which important factors affect catheter duration from the perspective of key stakeholders (patients and HCPs) by examination of the catheter removal process (Wald *et al.*, 2008). This thesis follows the early phases of the UK Medical Research Council (MRC) guidance on the development and evaluation of complex interventions (described in chapter two) and used theory-based qualitative methods with the application of the Theoretical Domains Framework (TDF; described in chapter three) (Michie *et al.*, 2005).

1.3 Aims and objectives

The overarching aim of this research was to develop an improved understanding of existing interventions, guidance documents, current catheter removal practices; and patient/ HCP related factors affecting the duration of short-term urinary catheters. The specific research objectives were to:

- Review current guidance documents on the timing of catheter removal (chapter 3)
- Conduct a detailed review of the literature on current initiatives and existing interventions designed to reduce catheter duration and CAUTI (chapter 3)
- Explore current catheter removal practices (chapter 4)
- Investigate HCP related barriers and enablers to prompt catheter removal practice (chapter 4)
- Explore current engagement behaviour of patients with HCPs regarding catheter removal (chapter 5)
- Investigate patient-related barriers and enablers to engagement regarding prompt catheter removal (chapter 5)
- Summarise findings to inform the development of a behaviour change intervention (chapter 6)

1.4 Outline of the thesis

To meet the aims and objectives, three main studies were conducted in this thesis.

- Study one: Literature review including review of the current guidance documents on catheter removal (chapter 3)

- Study two: HCP interview study exploring barriers and enablers to prompt catheter removal (chapter 4)
- Study three: Patient interview study exploring barriers and enablers to prompt catheter removal (chapter 5)

The above studies are described further in the chapter synopses below. The empirical chapters in this thesis are organised in a manuscript IMRaD (introduction, methods, results and discussion) format (Sollaci and Pereira, 2004). Thus, chapters four and five are presented in a standalone manner with separate abstract, introduction, methods, results and discussion sections to facilitate the planned dissemination of findings.

Chapter one provides an overall introduction to the thesis, research context, rationale for the research, aim and objectives, outline and brief summary by way of introducing each chapter.

Chapter two presents a background on the clinical context of CAUTIs. Firstly, it provides a definition of urinary tract infection (UTI) and CAUTI, the difference between the two, the clinical presentation and brief notes on its management. It then provides a background to CAUTI including the prevalence of indwelling urinary catheters and the burden attributable to these infections on patients and the healthcare system. The background to CAUTI is presented in the wider context of antimicrobial resistance, a national risk and threat to the UK. It describes my previous audit and research work to date that contributed to the inception of the current research. Next, the UK MRC framework for the development of complex interventions is explained, underpinning this body of research to identify overall barriers and enablers to prompt catheter removal. The chapter finally concludes with a brief description of the local NuTH NHS hospitals structure and ward layout in relation to the empirical findings described in chapters four and five and to help situate this research in the local context.

Chapter three describes a comprehensive review of the literature from both a clinical and theoretical perspective. The clinical context is considered as it pertains to urinary catheters and appraises existing intervention studies on the prevention and management of CAUTI. Current clinical guidance statements on catheter removal and national initiatives to prevent and reduce CAUTI are further considered. This is followed by an exploration of the role of theory in understanding barriers and enablers and to define specific target behaviours. The

chapter presents the rationale for the proposed work in study two, study population and the TDF used as a basis for the empirical studies presented in the thesis. Studies that have applied the TDF to identify barriers and facilitators in other clinical settings are also appraised.

Chapter four describes a TDF-based interview study undertaken with HCPs, including doctors, nurses and healthcare assistants, to explore current catheter removal practices in a local NHS hospital Trust and to identify barriers and enablers to prompt removal of short-term catheters. The chapter defines a specific target behaviour for HCP participants related to catheter removal as defined by the TACT-A (target, action, context, time and actors) principle (Francis and Presseau, 2019). It then describes the recruitment procedures, demographic characteristics, professional background and experience, and clinical specialties from which the participants were recruited. It then presents findings from the interviews, analysed with a deductive approach for the initial coding using the TDF as an analysis framework, followed by an inductive approach to generate sub-themes within the TDF domains to identify barriers and enablers to prompt catheter removal. This chapter concludes with a discussion of the strengths and limitations of this study and potential implications for future research, practice and policy.

Chapter five presents a TDF-based interview study conducted with hospitalised patients requiring a short-term urinary catheter (less than 14 days) during their hospital stay. The chapter describes the patients' specific target behaviour as per the TACT-A principle (Francis and Presseau, 2019) in the context of engaging with their HCPs for catheter removal, participants' demographic characteristics, inclusion/exclusion criteria, and recruitment procedures. The chapter continues with the presentation of interview findings, analysed using the same approach as the HCP interviews to draw out barriers and enablers to patient engagement for the prompt removal of their urinary catheter. It then provides a discussion of the strengths and limitations of the study and finishes with a brief conclusion.

Chapter six presents an overall discussion of the integrated research findings from studies 1-3, summarising and discussing key results described in chapters three, four and five respectively, in relation to the original aims and objectives of the thesis. Identified barriers concerning existing interventions, guidelines, and in the local healthcare setting context are discussed. The chapter then considers the overall strengths and limitations to this body of

research and steps for future research. The chapter describes the potential impact of findings on local practice, the estimated impact of a subsequent intervention on reducing catheter duration and CAUTI rates, and the potential impact on national and international healthcare policy and guidelines. Finally, the chapter concludes this thesis with a list of key summary points.

The overall key deliverable output of this thesis is an understanding of the relative importance of barriers and enablers that determine catheter duration from key stakeholders' perspectives, using TDF-based interviews with HCPs and patients. This will allow further work regarding the design of specific behaviour change intervention/s that can be used to achieve a reduction in catheter duration to agreed care standards in the hospital settings and thereby prevent associated infections.

Chapter 2. Background

2.1 CAUTI: a complex, multidimensional clinical problem

Prompt catheter removal to prevent catheter-associated urinary tract infections (CAUTIs) is a complex healthcare problem involving a multitude of reasons, a variety of individuals, and implicates inconsistencies in practice. Reducing and preventing CAUTI has been the focus of attention and ascribed global importance in an attempt to lessen the incidence of healthcare-acquired infections (HAIs). Despite the raised awareness and national/international initiatives, successful implementation of early catheter removal policy in practice has not been achieved which is likely to be associated both with patient and healthcare professional (HCP) related factors. This chapter provides a high-level background to CAUTI, related issues and previous research conducted locally that sets the scene for the empirical work presented in subsequent chapters.

2.2 Definitions of UTI and CAUTI

A urinary tract infection (UTI) is defined as a collective term for clinically detectable conditions associated with an invasion of the urinary tract by microorganisms which can affect the urethra, bladder, ureters, and kidneys (Centers for Disease Prevention and Control, 2017). A CAUTI is an infection of the urinary tract in the presence of an indwelling urethral catheter. Presentation of bacteriuria (bacteria in urine/pyuria) can be asymptomatic or symptomatic. Asymptomatic cases denote the presence of pyuria without symptoms. Patients are diagnosed with CAUTI if they present with symptoms such as acute haematuria (blood in urine), suprapubic tenderness or pain, and/or fever (Nicolle, 2014) and a positive microbiology urine test ($\geq 10^4$ CFU/ml) (Pickard *et al.*, 2012a). In microbiology terms, a colony-forming unit (CFU) is a unit to measure the number of viable (able to multiply) pathogens in a given sample (Goldman and Green, 2015). Although the treatment of asymptomatic bacteriuria should be avoided, symptomatic CAUTIs necessitate treatment with antimicrobial agents for its management. This bring its own global challenges in terms of antimicrobial resistance which calls for cutting down on the antibiotic prescriptions and antimicrobial stewardship (Bonkat *et al.*, 2017). In the CAUTI context, this can be achieved by reducing infections via removing catheters earlier.

2.3 Prevalence and impact

Approximately 15% of the 14.5 million patients admitted to UK NHS hospitals each year (over 2 million people) will require an indwelling urinary catheter at some time during their hospital stay (Nicolle, 2005; Bhardwaj *et al.*, 2010). In community settings, indwelling urinary catheter prevalence in elderly care facilities such as nursing homes is approximately 10% (McNulty, 2009). The presence of a catheter results in bacterial colonisation of the bladder at a rate of approximately 5% per day (Gokula *et al.*, 2004; Fukuoka *et al.*, 2018). This can lead to symptomatic CAUTI, which accounts for 20% of HAIs in UK hospitals (Bou-Antoun *et al.*, 2016; Smyth, 2006), over 6% of infections in community care homes (Roberts *et al.*, 2010), and causes death from sepsis in severe cases (Nicolle, 2005).

In older patients, these infections can cause delirium which instigates distress not only to the patients but also to the relatives and healthcare staff (Trautner, 2010). Delirium can be misdiagnosed as symptoms of dementia/cognitive impairment (Laurila *et al.*, 2008), leading to unnecessary further treatment and care burden on patients and their families. Delirium significantly increases comorbidities e.g. loss of bladder control due to loss of cognitive inhibition of voiding, increased risk of falls with subsequent complications such as fractures and cerebral bleeding (Lajiness, 2016; Folbert *et al.*, 2017). Taken together, these experiences can reduce older patients' overall confidence in returning to baseline activities, increase functional dependence on discharge, which can result in an altered discharge destination, and increased mortality (Muzzi-Bjornson and Macera, 2011; Davies, 2013). The latest figures on HAI from Field Epidemiology Service North East (Public Health England) shows that *E.coli* bacteraemia are reported at a rate of approximately 320 cases per month and around 2750 cases every year in the North East of England alone. Around 50% of these HAIs are associated with urinary catheters (Public Health England, 2017), the treatment of which is a risk factor for antimicrobial resistance development (Public Health England, 2015). Thus, what can begin as a seemingly 'minor' issue has the potential to escalate into significant issues for patients, their families, the health system, and the population health more generally.

2.4 CAUTI and antimicrobial resistance

The UK's Chief Medical Officer (CMO) highlighted the threat posed by the overuse of antimicrobial agents to cause a national risk and their link to antimicrobial resistance in the UK and worldwide (Davies, 2013). The impact of the antimicrobial resistance problem is serious, to the point of being compared to climate change, and was added to the Cabinet Office's National Risk Register of Civil Emergencies (Torjesen, 2013). CAUTI is one of the most common nosocomial infections, contributes substantially to antimicrobial resistance due to the necessary use of antibiotics for treating symptomatic and recurrent CAUTIs (Köves *et al.*, 2017b). To overcome the risk of antimicrobial resistance, it is necessary to prevent CAUTI in the first place, which would lower the requirement for antibiotic use for this indication (Bonkat *et al.*, 2017).

2.5 Work to date

Prior to the research presented in this thesis, I conducted a large cross-sectional audit (Bhardwaj *et al.*, 2010) and two studies on urinary catheter use within the local NHS Trust (NuTH) (Bhardwaj *et al.*, 2012; Pickard *et al.*, 2012a). These provided a background to my doctoral research and recognised prolonged catheter duration as a clinical problem and its impact on the quality of catheter care provided locally (described below).

The CATHETER Trial: I began working on the topic of urinary catheters and associated CAUTIs in 2008 as the Regional Lead Research Co-ordinator on a large UK multi-centre the CATHETER Trial (Pickard *et al.*, 2012a) funded by the UK National Institute for Health Research (NIHR) Health Technology Assessment Programme. The trial involved a randomised comparison (1:1:1) of two antimicrobial urinary catheters (silver alloy-coated and nitrofural-impregnated) with a standard polytetrafluoroethylene (PTFE) catheter for use in the NHS. The trial was conducted in 24 centres in the UK and included 7102 randomly allocated in-patient participants requiring planned short-term (less than 14 days) urinary catheterisation. I led the trial set up and conduct at six different sites in the North East of England. The trial found that the silver alloy-coated catheters were not effective in reducing the incidence of symptomatic CAUTI. There was some reduction noted in CAUTI incidence with nitrofural-impregnated catheters but this was not regarded as clinically significant. Therefore, routine use of

antimicrobial-impregnated catheters was not recommended in practice by this trial. While working on this trial, I noticed that fully mobile post-operative patients in neurosurgery (where I was based at the time) continued to be catheterised without an appropriate clinical indication, prolonging their catheter duration. This was the inception point of my research idea.

Cross-sectional audit: To investigate this further, in collaboration with the Catheter Care Sub Group (CCSG) at NuTH, I conducted a large audit of catheter prevalence, duration and CAUTI rates across the entire Trust. The findings showed post-operative catheter duration was longer than 3 days in 81% of patients (Bhardwaj *et al.*, 2010), compared with the recommended standard of 1 day (Gould *et al.*, 2010), highlighting a clear evidence-practice gap. My further work with the CCSG led to the development of the Catheter Care Plan (CCP) which was implemented within all hospitals of the Newcastle NHS Trust, and is well embedded into routine clinical practice now.

Pilot study: Following this audit, I designed and carried out a qualitative study with patients in the neurosurgical department on patients' perspectives of the timing of urinary catheter removal after surgery (Bhardwaj *et al.*, 2012). I gained a competitive national fellowship from the Medical Research Council (MRC Grant reference: C0209), obtained a master degree in Clinical Research with Distinction, and published the study findings (Bhardwaj *et al.*, 2012).

The pilot study explored factors of importance to patients undergoing elective surgery concerning the process of urinary catheterisation, with the use of semi-structured interviews. The results highlighted the patients' lack of knowledge about catheters which caused concerns and anxiety (Bhardwaj *et al.*, 2012). The study also identified that patients were not routinely consented for perioperative catheter insertion. Other factors of importance to patients were loss of dignity, lack of involvement in the decision-making process for catheter removal, and lack of awareness of the association between catheter duration and CAUTI. Environmental factors such as a lack of easily accessible toilet facilities were also important to patients and this contributed to prolonged catheterisation. Most patients felt that their catheter could have been removed earlier and they were keen to be empowered to contribute to that decision.

Current project: Collectively, my previous work suggested that with input from patients and HCPs, there is a potential to change patterns of care to reduce unnecessarily prolonged catheterisation. Subsequently, I planned to further expand this research (via the research presented in this doctoral thesis), as the pilot study was conducted on a small scale and participants were only recruited from a single clinical area (the neurosurgical unit). Also, this work only included patient views; the views of HCPs were not sought. To allow transferability and explore speciality-based factors it was necessary to undertake a detailed investigation by expanding the study to other clinical areas, covering both medical and surgical specialities. The research purpose was to investigate HCPs' beliefs and further explore patients' beliefs in terms of defined targeted behaviours to identify overall barriers to prompt catheter removal.

To conduct this research, I was awarded a competitive personal fellowship from the NIHR (Clinical Doctoral Research Fellowship; Grant Reference: CDRF-2012-03-006) and produced multiple outputs from this research (reported in the thesis outputs section).

2.6 The UK MRC Framework

The research design aligns with the UK MRC framework for the development of complex interventions (Craig *et al.*, 2008). The MRC guidance highlights the importance of identifying the evidence base of a complex problem with the use of theory, modelling processes and identification of factors that influence outcomes (barriers and enablers) in the early stages of intervention development. The focus of this thesis was on the development phase as highlighted in Figure 2.1. This framework also emphasises the need for a strong theoretical understanding to identify weak links which can be identified and strengthened. The framework, therefore, supports the aim and objectives of the thesis and the need to conduct a thorough investigation to identify barriers and enablers using a systematic theory-informed approach.

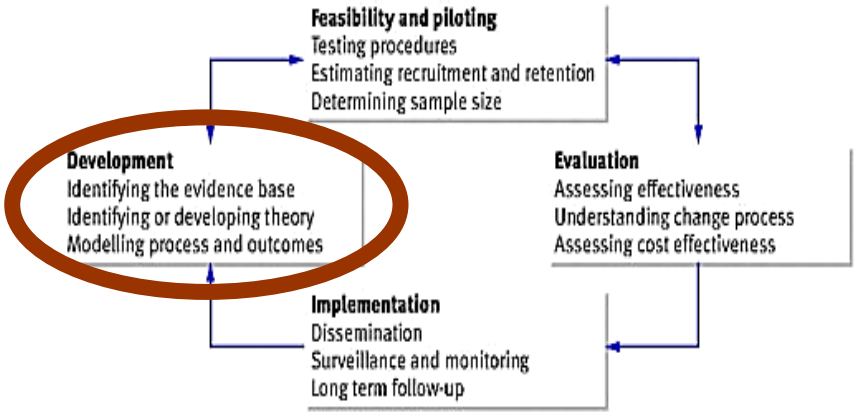


Figure 2.1: Developing and Evaluating Complex Interventions (Craig *et al.*, 2008)

This project employed theory-informed qualitative methods by using the Theoretical Domains Framework (TDF) to identify the most important factors that determine catheter duration from both patient and clinician perspectives (Michie *et al.*, 2005). The TDF is described in the literature review (chapter three). Any subsequent intervention is expected to be tailored to local contexts, developed using the insights provided by the theoretical underpinning of complex behaviours in complex adaptive systems, and likely to have multiple interacting behavioural components (Shiell *et al.*, 2008). It is, therefore, important to understand a range of factors and perspectives associated with behaviours of catheterised patients and HCPs who are responsible for the timely removal of catheters. Identified deficiencies can then be used to design the intervention by mapping key findings to relevant theories and behaviour change techniques (Wood *et al.*, 2015).

2.7 Local NHS hospitals structure and ward layout

This section describes the structure of the local NHS Trust hospitals (NuTH) relevant to the context and findings described in the empirical chapters four and five. NuTH is one of the busiest and largest teaching trusts in the UK, with an 1800-bed capacity and over 14,000 employed staff, and spread over seven sites in Newcastle and the surrounding areas (The Newcastle upon Tyne Hospitals NHS Foundation Trust: NUTH, 2019). Over the last decade, there has been major expansion work carried out to modernise and host some of the specialist services provided in Newcastle such as the regional Cardiothoracic Centre at the Freeman Hospital, the Great North Children's Hospital, the Great North Trauma and Emergency Centre,

the Newcastle Centre for Cancer Care and the Institute of Transplantation where Europe's first successful paediatric heart transplant was carried out.

The pilot study described above (Bhardwaj *et al.*, 2012) was carried out at the Neurosurgical Department at the Newcastle General Hospital, the second oldest hospital in the city, founded in 1870. Due to the traditional physical layout of wards, in the hospital, patients had to share toilet facilities. Toilets were located in the corridor leading to the ward, approximately 50 yards (45 meters) away from a patient's bedside. Depending on the type of surgery patients had undergone, this affected patients' ability to use the toilet in the 24-72 hour post-operative period which was identified as one of the barriers to prompt removal of catheters. Since then, the clinical facilities at the General Hospital have been moved to a new site. The modern ward layout now has a provision of one toilet in each bay (room) shared by six patients with an additional toilet at each end of the corridor. This design is much improved compared to the traditional layout at the General Hospital site where the pilot study was carried out. However, limitations related to location and accessibility of the toilets persist, as reported by patient participants described in chapter five. In the patients' environment, there is a call-bell system in operation which patients can use to engage with staff or get assistance as and when required.

2.8 Summary

This chapter has provided an overall clinical background to the research programme, related research work conducted to date, setting the scene for the next chapter (the literature review) and the overall thesis. The UK MRC framework underpinning this research has been described and a brief description of the local NHS Trust structure and ward layout concluded the chapter to contextualize the empirical findings in the local environment.

Chapter 3. Literature review (Study one)

3.1 Overview of chapter

In this chapter, a comprehensive review of the literature is presented. The literature review explored the most important aspects of the available evidence on indwelling urinary catheters and catheter-associated urinary tract infections (CAUTIs) in clinical, theoretical and implementation research contexts (Derish and Annesley, 2011; Grant and Booth, 2009; Cronin *et al.*, 2008). This chapter also includes a review of the national and international guidance documents on the timing of catheter removal, current initiatives, and previous interventions designed to reduce CAUTIs thus far. The review synthesised evidence on patterns and trends of previous CAUTI interventions; identified gaps in the body of evidence; and justified the research objectives, population, and methods outlined in this thesis (chapters three, four and five). Figure 3.1 illustrates different facets of the literature search and current chapter structure.

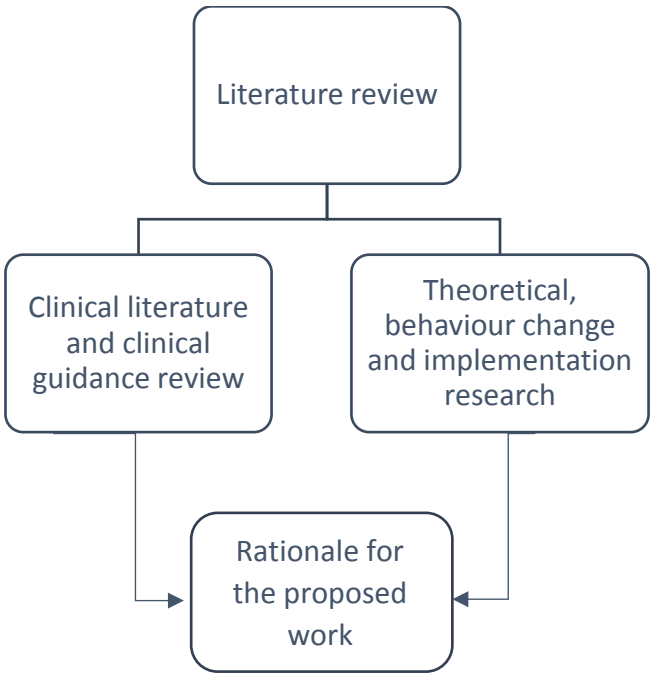


Figure 3.1: Overview of the literature review chapter

3.2 Focus of the literature review

3.2.1 Search strategy

The search strategy was developed in collaboration with two information scientists (Erika Gavilett and Fiona Beyer) who assisted in the development of search terms and the identification of relevant research sources and databases. The search terms and search strings were iteratively expanded to create key words for searching individual databases and appropriate mesh terms. The initial literature searches were carried out in July 2013. The databases searched were: Medline, Embase, Web of Science, PubMed, PsycINFO, Scopus, the Cochrane Library, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), and the BioMed Central (BMC) online library of articles on the *Theoretical Domains Framework for Behaviour Change Research*. Simultaneously, supplementary literature was identified via websites, Google scholar, and online published reports. In addition, the UK, European and American guidance documents on urinary catheters were also reviewed. Where possible, searches were restricted to studies that used urinary catheters in humans. Subsequent automatic search alerts provided up-to-date literature, included until the production of this thesis. The main focus of this literature review was to synthesise a body of knowledge from a clinical and implementation science perspective, by collating a broad range of evidence from various different sources to develop a further understanding and by addressing the following objectives:

- Appraising the UK national, European and American guidance documents on catheter removal.
- Identifying and summarising previously published interventions attempted to reduce catheter duration and subsequent CAUTIs.
- Appraising the implementation science literature comprising of studies that utilised theoretical frameworks and theory-based behaviour change interventions to identify and address barriers to improve clinical practice.

3.2.2 Selection criteria

Population, setting and context: studies of adults and elderly participants with urethral catheters, the prevention and management of CAUTIs, and the microbiology of CAUTI development were included. Clinical studies conducted in a primary or secondary care setting

with heterogeneous catheter indications were included. Studies focusing solely on long-term chronic catheters were excluded to increase the relevance of the findings to a short-term catheterised population.

Study design: quantitative, qualitative, mixed-methods, exploratory and interventional studies published in English were included. No limits were placed on the type of evaluation employed as the aim was to assess the interventions used.

Study selection: searches were imported and managed in EndNote version X7 with duplicate articles removed. In the initial phase, the titles and abstracts of the retrieved articles were screened, followed by a full text screening of retained articles.

Data synthesis: due to the divergent nature of research questions and populations, the evidence was synthesised in a clinical, theoretical, and implementation science context.
Various sources of literature were used to develop an understanding of CAUTI related behaviours and existing interventions.

3.3 Clinical Context

3.3.1 Indwelling urinary catheters

An indwelling urinary catheter is a thin long tube made from either latex, polyurethane or silicone inserted into the bladder through the external urethral meatus. A catheter allows the urine to flow passively from the bladder into a collection bag without the need for patient to actively urinate. Catheters are used for a longer duration for incontinence, neurogenic bladder and chronic medical conditions where a patient is unable to urinate independently. Indications for short term catheterisation are generally: acute retention, urine output monitoring in acute conditions, the necessity to drain the bladder while the patient is under anaesthetic for surgical procedures and a catheter left in situ post-operatively for a patient's comfort (Nicolle, 2012). However, the appropriateness of the indication and routine use of urinary catheters has been examined since the late fifties (Beeson, 1958). Catheters intended for short-term placement are often left in situ for longer than needed (Adams *et al.*, 2012) putting patients at high risk of acquiring catheter-associated infections (Clarke *et al.*, 2012) and causing considerable burden on patients in terms of discomfort, pain, morbidity and even death

(Pickard *et al.*, 2012a). Furthermore, this can impact the healthcare system due to increased treatment costs (Danchaivijitr *et al.*, 2005). Despite clear evidence of its detrimental effects, unjustified and prolonged use of catheters persist (Saint *et al.*, 2002; Meddings *et al.*, 2019).

3.3.2 Catheter-associated urinary tract infections

A CAUTI is an infection of the urinary tract in the presence of a urinary catheter. Pathogens gain entry through the catheter invading the inner and outer surfaces, and provide a favourable environment for bacterial growth and subsequent colonisation (Barford and Coates, 2009). Catheters provide a suitable surface for pathogens to create a biofilm which protects colonising bacteria from antimicrobials (Holenarasipur *et al.*, 2013). The presence and longer duration of a urinary catheter are the most important risk factors for biofilm formation and developing bacteriuria at a rate of approximately 5% per day (Vergidis and Patel, 2012; Gokula *et al.*, 2004; Fukuoka *et al.*, 2018). The biofilm is formed in five stages: 1) initial bacterial attachment to a surface, 2) irreversible attachment, 3) maturation phase one, 4) maturation phase two and finally 5) dispersion (as shown in Figure 3.2).

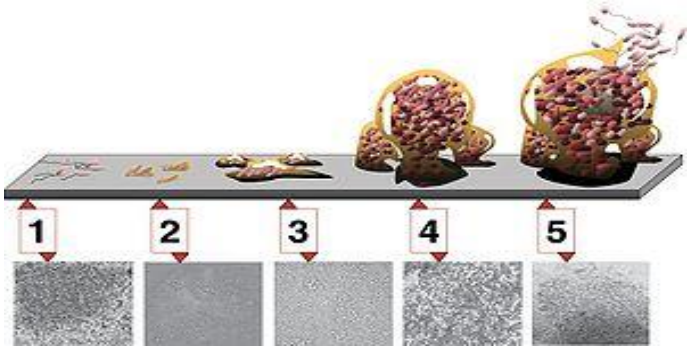


Figure 3.2: Stages of bacterial biofilm formation

(Image: Freely licenced: D. Davis - From: D. Monroe. "Looking for Chinks in the Armor of Bacterial Biofilms". PLoS Biology 5 (11, e307) DOI:10.1371/journal.pbio.0050307)(O'Toole *et al.*, 2000).

Dispersion of bacteria in urine then leads to asymptomatic and symptomatic bacteriuria and subsequent CAUTI (Trautner and Darouiche, 2004; Sabir *et al.*, 2017). However, a CAUTI may be prevented if a catheter is removed before the biofilm is formed.

The impact of CAUTIs is substantial due to the high prevalence of urinary catheter use (Saint *et al.*, 2009). About 300,000 of 2 million catheterised patients in the UK National Health Service (NHS) hospitals suffer from CAUTIs every year, making it one of the most common

sites of healthcare-acquired infections (HAIs) in acute and extended healthcare facilities (Bjerklund Johansen *et al.*, 2007). CAUTIs cost the UK NHS alone around £164 million annually for managing the infection and associated additional treatment (Pickard *et al.*, 2012b).

3.3.3 Management of CAUTIs

A CAUTI is mostly caused by Gram-negative bacteria and needs to be treated with effective antimicrobial therapy alongside removing or replacing the catheter, which is the prime source of infection (Ksycki and Namias, 2009). However, asymptomatic catheter-related bacteriuria is often inappropriately treated with antibiotics (Köves *et al.*, 2017a). A systematic review and meta-analysis including seven controlled studies (six RCTs and one non-randomised controlled intervention study), reported that prophylactic antibiotics at the time of catheter removal were effective at preventing a CAUTI (Marschall *et al.*, 2013). However, making it a routine practice may have implications in terms of potential side-effects, development of antimicrobial resistance and the cost of antibiotics (Health Protection Agency: Public Health England, 2012). This approach should be selective and used only on patients who are most likely to benefit from prophylactic antibiotics, for example, clean intermittent self-catheterised patients (Vallée *et al.*, 2019).

3.3.4 Initiatives to prevent CAUTIs

Clinical initiatives: possible ways to avoid CAUTIs include limiting the use of catheters (Rothfeld and Stickley, 2010) or to reduce catheter duration (Fernandez and Griffiths, 2006). The burden of CAUTIs on patients and the healthcare system has led to national and international initiatives for their prevention. As part of this strategy, a commissioned review including 37,111 patients overall from 157 centres (Emmerson, 1996), identified the two main risk factors for CAUTIs as 1) contamination during catheter insertion and 2) duration of catheterisation (Emmerson, 1996; EPIC, 2001; Loveday *et al.*, 2014; Fukuoka *et al.*, 2018). Training, surveillance and monitoring of urinary catheter insertion have helped to reduce catheter prevalence and the risk of CAUTIs (Marigliano *et al.*, 2012), but the reduction in duration of catheterisation has proved harder to implement because it requires a change in standard practice (Wald *et al.*, 2008; Niël-Weise and van den Broek, 2005).

Additional factors which may assist in preventing CAUTIs are: restricted catheter use (which can be applicable in certain clinical situations), strict adherence to the preservation of a closed drainage system (for maintaining a sterile track), and appropriate indication for insertion

(Hustinx and Verbrugh, 1994). Inappropriate and prolonged use of catheters has been reported to range from 20% (Caramujo *et al.*, 2011) to more than 43% (Mikolajczak *et al.*, 2013) in catheter prevalence studies, which leads to subsequent yet avoidable CAUTI. For example, it is routine practice for patients undergoing spinal or epidural anaesthesia to have a catheter inserted due to high risk of urinary retention (inability to pass urine). However, results from a randomised prospective study by Miller and colleagues (2013) with 200 patients who received spinal anaesthesia for undergoing total hip arthroplasty showed that such patients are not at high risk of retention and routine urinary catheter placement is not necessary (Miller *et al.*, 2013). Also, if the catheter is a necessity for a lengthy surgical procedure, it does not need to stay in situ for the entire duration that the patient is under anaesthetic (Zaouter *et al.*, 2009; Nygren *et al.*, 2012). Research also shows that catheterised patients with diarrhoea are at higher risk of acquiring a CAUTI due to cross-contamination of the urethral meatus and removal of the catheter should be considered where possible (Lima *et al.*, 1990). Therefore, healthcare professionals (HCPs) need to be extra vigilant when assessing the need for catheter insertion. The 'Choosing Wisely' initiative supports this approach by advocating limiting the use of catheters to reduce CAUTIs in hospitalised inpatient wards (Cho *et al.*, 2017).

In limiting the use of catheters, alternative methods should be considered for bladder emptying before their insertion (Saint, 2000) e.g. via use of a commode, bedpan/urinal, external condom catheters, or suprapubic and intermittent catheterisation for patients with neurogenic impairment affecting bladder emptying (Nicolle, 2012). Alternative methods produce a lower incidence of bacteriuria and result in fewer complications (Warren, 1997). A review reported that suprapubic catheters (SPC) result in fewer urinary tract infections (UTIs) in comparison to transurethral catheters (Healy *et al.*, 2013) and an SPC is recommended when extended need for external bladder drainage is predicted, although insertion is more invasive (Nygren *et al.*, 2012). For people with an indwelling catheter, a trial without catheter (TWOC) should be considered when appropriate, both in a hospital (Emberton and Fitzpatrick, 2008) and community setting (Robinson, 2005) before catheter replacement.

For long term catheter placement, the formation of a bacterial biofilm is inevitable. Biofilms form when cells of microorganisms/pathogens adhere to each other on a surface (Donlan, 2002), as shown in Figure 3.2. A systematic review suggests that bacteria living inside biofilms

are more protected and resistant to anti-microbial therapies than non-biofilm bacteria (del Pozo *et al.*, 2008) contributing to antimicrobial resistance.

Alternative methods to early removal have been attempted to reduce the adherence of bacteria to the catheter surface. Biologically, attempts have been made to use non-pathogenic bacteria to prevent adherence of pathogenic bacteria to the catheter (Holenarasipur *et al.*, 2013). Other attempts have been made to prevent the formation of a biofilm by running low-energy ultrasound or electric waves to the catheter surface in long term catheter use (del Pozo *et al.*, 2008; Nagy *et al.*, 2011). Biofilm disruptive strategies may offer some evidence to delay the formation of a biofilm but the immediate implementation of these methods in practice remains limited (Trautner *et al.*, 2005).

The efficacy of modifications to catheter material in the prevention of symptomatic CAUTIs has also been evaluated e.g. antimicrobial and antiseptic-impregnated catheters, and different materials such as silicon rather than conventional latex. Results from a large RCT *the CATHETER Trial* (described in chapter 2, (Pickard *et al.*, 2012a)) showed that the antimicrobial impregnated catheters were slightly more effective at reducing CAUTIs when compared to standard PTFE latex catheter but the effect was not clinically significant. Therefore, they were not recommended for routine use. Antiseptic silver alloy-coated catheters were no more effective for CAUTI prevention than standard catheters (Pickard *et al.*, 2012a).

National initiatives in the UK: Although catheterisation is a minor procedure, complications (mainly CAUTIs) can have extensive implications on patients' morbidity, mortality and healthcare costs (Danchaivijitr *et al.*, 2005; Pickard *et al.*, 2012b). The high prevalence of CAUTIs caused by Gram-negative bacteria and their impact has led to growing momentum in healthcare systems worldwide to prevent the occurrence of hospital-acquired infections (Raad *et al.*, 2007). Consequently, CAUTI prevention was included as one of the key 'high impact interventions' for the 'Saving lives' and 'Patient Safety Thermometer' in measuring harm free care initiatives introduced to NHS hospitals by the Department of Health (DoH) in 2007 and 2012, in which reducing CAUTI/UTI rates remains a key priority for the DoH (Department of Health, 2007; Department of Health, 2012). Furthermore, the Health & Social Care Act, 2008 (Department of Health, 2009), imposes a legal obligation on NHS trusts to ensure that patients, healthcare workers and others are protected from identifiable risks

of acquiring healthcare-associated infections; The High Impact Actions for Nursing and Midwifery advises that continued vigilance is required to protect patients from HAIs (Department of Health, 2009). These policy and guidance documents emphasise adherence to evidence-based practice in infection control (epic) guidelines, which require close collaboration between all staff and patients involved in catheter care (EPIC, 2001; Loveday *et al.*, 2014; Pratt *et al.*, 2007).

3.3.5 Review of UK, European and international guidance documents

Clinical guidelines are produced to outline best practice informed by research evidence to promote change in practice (Foy *et al.*, 2002). Change in a given behaviour or clinical practice may be more achievable if the clinical personnel concerned act in accordance with the relevant guidelines, balanced with their professional discretion. Therefore, it is important to have clear and specified guidelines to achieve the desired level of adherence (Michie and Abraham, 2004). Acting in accordance with clinical guidelines and policies, i.e. the extent to which recommendations are adhered to as specified, poses difficult challenges. As described by Miller and colleagues (1997), compliance is a means to an end, an approach to maintain and improve behaviours. It is a complex behavioural process strongly influenced by the environments in which patients live, healthcare providers practice, and healthcare systems deliver care (Miller *et al.*, 1997). An overview at a glance of the national, European and international guidance on catheter removal has been provided in Table 3.1.

Table 3.1: An overview of UK, European and international guidance on catheter removal

Title	Statement	Reference
UK guidance		
High Impact Interventions 6- Department of Health guidance	*"Review regularly the patient's need for continuing urinary catheterisation and remove the catheter as soon as possible"* and "*Patients and relatives should be educated about their role in preventing UTI*"	High Impact Intervention 6, (Department of Health, 2007, p.2)
CG139- 'Healthcare-associated infections: prevention and control in primary and community care'	*"The patient's clinical need for catheterisation should be reviewed regularly and the urinary catheter removed as soon as possible".*	CG139 (National Institute for Health and Care Excellence, 2012, p.19)
QS61- 'Infection prevention and control' Quality statement 4: Urinary catheters	*"Remove as soon as it is no longer needed"*	Section: Assessing the need for catheterisation (National Institute for Health and Care Excellence, 2014, p.23)
epic3 guidelines on 'Preventing Infections Associated with the Use of Short-Term Indwelling Urethral Catheters'	*"Assess and record the reasons for catheterisation every day. Remove the catheter when no longer clinically indicated"* (UC3: page 33) and *"Ensure patients, relatives and carers are given information regarding the reason for the catheter and the plan for review and removal"* (UC22: page 36)	(Loveday *et al.*, 2014, p.33 & 36)
NG113 'Catheter-associated urinary tract infection and antimicrobial prescribing'	No reference to the timing of catheter removal in 'CAUTI prevention' section	(National Institute for Health and Care Excellence, 2018)

European guidance		
European guidelines on urological infections	*"The duration of catheterisation should be minimal"*	European Association of Urology (EAU) (Bonkat *et al.*, 2017, p.24)
International guidance		
Guideline for Prevention of Catheter-associated Urinary Tract Infections - Healthcare Infection Control Practices Advisory Committee (HICPAC)	"*For operative patients who have an indication for an indwelling catheter, remove the catheter as soon as possible postoperatively, preferably within 24 hours, unless there are appropriate indications for continued use*"	American Centers for Disease Control and Prevention (CDC) HICPAC, 2009 (Gould *et al.*, 2010, p.10)- updated June 2019

There were multiple sources identified for clinical guidelines and quality statement documents to regulate catheter removal practices in addition to the management and prevention of CAUTIs. In the UK, these include Department of Health guidance on 'High Impact Interventions 6' (Department of Health, 2007); CG139 clinical guidance on 'Healthcare-associated infections: prevention and control in primary and community care' by the National Institute for Health and Care Excellence (NICE) (National Institute for Health and Care Excellence, 2012); NICE QS61 on 'Infection prevention and control' including quality statement four on Urinary catheters (National Institute for Health and Care Excellence, 2014); and epic3 guidelines for 'Preventing Infections Associated with the Use of Short-Term Indwelling Urethral Catheters' (Loveday *et al.*, 2014). The guidance on High Impact Intervention number 6 on urinary catheters suggests to: *"Review regularly the patient's need for continuing urinary catheterisation and remove the catheter as soon as possible"* and "*Patients and relatives should be educated about their role in preventing UTI*" (Department of Health, 2007, p.2).

NICE clinical guidance CG139 states, *"The patient's clinical need for catheterisation should be reviewed regularly and the urinary catheter removed as soon as possible"* (National Institute for Health and Care Excellence, 2012, p.19). NICE QS61 states *"remove as soon as it is no longer needed"* (National Institute for Health and Care Excellence, 2014)(National Institute for Health and Care Excellence, 2014, p.23). The epic3 guidance on urinary catheters UC3 states *"Assess and record the reasons for catheterisation every day. Remove the catheter when no longer*

clinically indicated" (Loveday *et al.*, 2014, p.33). The epic3 guidance UC22 also suggests involving patients and relatives *"Ensure patients, relatives and carers are given information regarding the reason for the catheter and the plan for review and removal"* (Loveday *et al.*, 2014, p.36). Despite the evidence on the association between prolonged catheter duration and increased incident of CAUTIs (Loveday *et al.*, 2014; Fukuoka *et al.*, 2018); there is no reference to the timing of catheter removal in the 'CAUTI prevention' section of the NICE guidance NG113 titled 'Catheter-associated urinary tract infection and antimicrobial prescribing' (National Institute for Health and Care Excellence, 2018).

The European guidelines on urological infections are underwritten by the European Association of Urology (EAU) (Bonkat *et al.*, 2017). The focus of this guideline is on the management of catheter infections (CAUTIs) with antibiotic treatment and provides minimum guidance on the timing of catheter removal. Regarding catheter duration, it states: *"The duration of catheterisation should be minimal"* (Bonkat *et al.*, 2017, p.24).

The guidance from the American Centers for Disease Control and Prevention (CDC) in the *Guideline for Prevention of Catheter-associated Urinary Tract Infections* (2009), updated June 2019), suggests: "*For operative patients who have an indication for an indwelling catheter, remove the catheter as soon as possible postoperatively, preferably within 24 hours, unless there are appropriate indications for continued use*" (Gould *et al.*, 2010, p.10). In addition to this statement, the guidance provides a list of examples for appropriate and inappropriate catheter indications for the prevention of CAUTIs (see Table 3.2) (Gould *et al.*, 2010, p.11).

Table 3.2: US Centers for Disease Control and Prevention criteria for appropriate and inappropriate indications for indwelling urinary catheters (Centers for Disease Prevention and Control, 2009)

A. Examples of appropriate indications for indwelling urethral catheter use

- Patient has acute urinary retention or bladder outlet obstruction
- Need for accurate measurements of urinary output in critically ill patients
- Perioperative use for selected surgical procedures:
    - Patients undergoing urologic surgery or other surgery on contiguous structures of the genitourinary tract
    - Anticipated prolonged duration of surgery (catheters inserted for this reason should be removed in PACU)
    - Patients anticipated to receive large-volume infusions or diuretics during surgery
    - Need for intraoperative monitoring of urinary output
- To assist in the healing of open sacral or perineal wounds in incontinent patients
- Patient requires prolonged immobilization (e.g., potentially unstable thoracic or lumbar spine, multiple traumatic injuries such as pelvic fractures)
- To improve comfort for end of life care if needed

B. Examples of inappropriate uses of indwelling catheters

- As a substitute for nursing care of the patient or resident with incontinence
- As a means of obtaining urine for culture or other diagnostic tests when the patient can voluntarily void
- For prolonged postoperative duration without appropriate indications (e.g., structural repair of the urethra or contiguous structures, prolonged effect of epidural anaesthesia, etc.)

In summary, the UK and European guidance around urinary catheters does not include specific reference to the timing of catheter removal. Whereas, the guidance from the United States is

more precise and recommend catheter removal within 24 hours unless there is an appropriate and documented indication for its continued use.

The attention on minimising catheter duration is poor across the range of UK and European guidelines appraised here, showing the evidence gap regarding strategies to reduce catheter duration. This review demonstrates the need for improvement of NICE, epic3 and EAU guidance. Like the CDC guidance (removal within 24 hours), the UK documents should provide specific guidance on the timing of catheter removal which HCPs can use as a benchmark to follow for the removal of clinically appropriate catheters. The specificity of catheter removal time in guidance documents is of particular importance especially when the focus of existing interventions to reduce CAUTIs is moving towards early catheter removal.

3.3.6 Interventions to date

This review identified a multitude of interventions designed to combat UTIs occurring due to the insertion of a urinary catheter that is often used inappropriately (Gokula *et al.*, 2004). The studies focusing on urinary catheterisation in adult patients using qualitative, quantitative or mixed-methods were reviewed.

There are four common steps before a catheter can be removed (Meddings *et al.*, 2010): 1) a physician becomes aware that patient has a urinary catheter, 2) a physician recognises that there is no clinical indication for a catheter to be continued, 3) a physician writes a removal order, and 4) a nurse follows the physician's order and removes the catheter. Traditionally, these steps follow one after the other (sequential), and this sequence can contribute to longer catheter duration. Some interventions have tried to shorten the catheter removal process by bypassing some of these steps. For example, the implementation of nurse-driven catheter removal protocols eliminates the need for a doctor to initiate the removal process. It enhances the nurse's ability to remove the catheter as well as make the removal decision, thus, achieving both in a timely manner. The overall interventions identified in the review have been summarised below under the categories of limiting catheter use, education and training interventions, and interventions that emphasise on early catheter removal. The latter category is further organised into the type of interventions used for prompt catheter removal such as adaptation and changes to staffing level, nurse-driven protocols or reminder interventions. A summary of interventions has been provided in Table 3.3.

Table 3.3: Summary of interventions

Intervention type/ Number of studies	Type of study	Author/s (year)	Sample size	Clinical setting
Limiting the use of catheter (n=2)	Randomised controlled trial	Chia *et al.,* (2009)	n= 78 patients	Hospitalised patients requiring elective thoracotomy
	Audit	Long *et al.,* (2013)	n= 100 patients	Hospitalised patients requiring elective caesarean section
Education and Training interventions (n=6)	Systematic review	Jones *et al.,* (2018)	n= 26 studies	A systematic review of studies to examine effectiveness of behavioural interventions to reduce E. coli bacteraemia and/or symptomatic UTIs for older adults
	Review of CAUTI prevention strategies	Lo *et al.*, (2014)	n= 23 guidelines and recommendations	A review of published guidelines and recommendations for prevention of infections associated with short-term indwelling urethral catheters

Uncontrolled pre-post	Sundaram *et al.,* (2012)	n= 1434 patients	Patients requiring cardiac surgery on a cardiovascular unit in a tertiary care hospital
Uncontrolled pre-post	Gordon (2015)	n= 63 nurses	Effects of nursing education on evidence based practice guidelines to decrease CAUTI rates in hospitalised patients on a medical surgical unit
Uncontrolled pre-post	Justus *et al.,* (2016)	n= not identified	A blended learning approach by combining feedback with education on catheter insertion and care to healthcare providers in hospital setting
Uncontrolled pre-post	Dyc *et al*., (2011)	n= 30 doctors	A peer-to-peer educational intervention implemented to doctors on appropriate use of urinary catheter placement in the emergency department

Emphasis on early catheter removal (n=3)	Systematic review	Fernandez and Griffiths, (2006)	n = 8 trials	A systematic review of trials comparing the effects of catheter duration on patient outcomes
	Prospective cohort study	Apisarnthanarak *et al.,* (2007)	n= 131 patients	Hospitalised catheterised patients from surgical and medical intensive care units
	Audit	Hartstein *et al.,* (1981)	n= 108 patients	Hospitalised patients with indwelling urethral catheters for acute medical and surgical indications
Shorter versus longer catheter duration (n=11)	Systematic review/ meta-analysis	Nygren *et al.,* (2012)	n= 26 peri/post-operative outcomes	A systematic review and meta-analysis of RCTs implementing multimodal peri/post-operative care pathways for removal of urinary catheters in rectal surgery patients

Cochrane review/ meta-analysis	Phipps *et al.,* (2006)	n= 11 RCTs	A Cochrane review of RCTs concerning short term urinary catheter policies following urogenital surgery in adults
Randomised controlled trial	Glavind *et al.,* (2007)	n= 140 patients	Catheterised patients after vaginal prolapse surgery in a hospital setting
Randomised controlled trial	Sekhavat *et al.,* (2008)	n= 90 patients	Hospitalised and catheterised patients after anterior colporrhaphy surgery
Randomised controlled trial	Kamilya *et al.,* (2010)	n= 200 patients	Hospitalised and catheterised patients after vaginal prolapse surgery
Randomised controlled trial	Huang *et al.,* (2011)	n= 90 patients	Hospitalised and catheterised patients after anterior colporrhaphy surgery
Randomised controlled trial	Weemhoff *et al.,* (2011)	n= 246 patients	Hospitalised and catheterised patients after anterior colporrhaphy surgery

	Randomised controlled trial	Ouladsahebmadarek *et al.,* (2012)	n= 200 patients	Hospitalised and catheterised patients for hysterectomy or laparotomy
	Prospective cohort study	Kawahara *et al.,* (2013)	n= 93 patients	Hospitalised and catheterised patients requiring ureteroscopic lithotripsy using ureteral access sheath
	Retrospective cohort study	Chalise *et al.,* (2007)	n= 52 patients	Hospitalised and catheterised patients after transurethral resection of prostate
	Retrospective cohort study	Turnbull *et al.,* (2012)	n= 30 patients	Hospitalised and catheterised patients after radical hysterectomy
Timing of catheter removal: midnight versus early morning removal (n=6)	Systematic review	Fernandez *et al.,* (2003)	n= 8 RCTs	A systematic review of randomised controlled trials comparing the effectiveness of early morning versus late night removal of urinary catheters

Systematic review	Fernandez and Griffiths, (2006)	n= 8 Trials	A systematic review of comparison trials of late night and early morning removal of short-term urethral catheters
Randomised controlled trial	Ind *et al.,* (1993)	n= 101 patients	Hospitalised patients with postoperative urethral catheters
Randomised controlled trial	Crowe *et al.,* (1994)	n= 282 patients	Randomised comparison of catheterised patients- midnight versus early morning catheter removal in a hospital setting
Randomised controlled trial	Kelleher, (2002)	n= 160 patients	Randomised comparative trial of catheterised patients to determine the impact of midnight catheter removal on voiding patterns and subsequent hospital discharge
Qualitative ethnographic study	Deitrick *et al.,* (2006)	n= a 36-bed medical-surgical unit	Ethnographic observation in a hospital-based ward setting

Nurse-driven catheter removal protocols (n=4)	Systematic review/ meta-analysis	Meddings *et al.,* (2010)	n= 14 studies	A review of interventional studies using stop orders and reminder systems to prompt catheter removal in hospitalised adults
	Randomised controlled trial	Skelly, (2008)	n= 7 general medical units	A randomised controlled trial of automatic stop orders to reduce catheter duration in three different hospitals
	Interrupted time series study	Sadeghi *et al.,* (2019)	n= not identified	Nurse-initiated medical directive to implement early catheter removal in the operating theatre to reduce postsurgical UTI rates in a hospital setting
	Quality improvement pilot study	Adams *et al.,* (2012)	n= 3 wards	PDSA study of non-surgical catheterised patients on elderly care, medical gastroenterology and respiratory medicine wards

Reminder interventions (n=8)	Systematic review/ meta-analysis	Meddings *et al.,* (2010)	n= 14 studies	A review of interventional studies using stop orders and reminder systems to prompt catheter removal in hospitalised adults
	Randomised controlled trial	Loeb *et al.,* (2008)	n= 692 patients	Hospitalised patients with indwelling urinary catheters inserted for over 48 hours
	Randomised controlled trial	Skelly, (2008)	n= 7 general medical units	Catheterised patients in a hospital setting
	Randomised controlled trial	Chen *et al.,* (2013)	n= 278 patients	RCT conducted on two respiratory intensive care units in a large tertiary care hospital
	Cross-over design	Cornia *et al.,* (2003)	n= 742 patients	Patients from medicine and cardiology services
	Uncontrolled pre-post	Bruminhent *et al.,* (2010)	n= not identified	A reminder sticker intervention for clinicians for discontinuation of urinary catheter in a community teaching hospital

	Uncontrolled pre-post	Seguin *et al.,* (2010)	n= 1271 patients	A daily reminder to physicians on hospitalised catheterised patients' care sheets to reduce infection rates
	Retrospective cohort study	Baillie *et al.,* (2014)	n= not identified	Evaluating the usability and effectiveness of a computerised clinical decision support in a teaching hospital
Multifaceted bundle interventions (ERAS+ bladder bundle)				
ERAS pathway (n=5)	Systematic review/meta-analysis	Nygren *et al.,* (2012)	n= 26 peri/post-operative outcomes	A systematic review and meta-analysis of RCTs implementing multimodal peri/post-operative care pathways for prompt catheter removal in rectal surgery patients

	Systematic review/meta-analysis	Varadhan *et al.,* (2010)	n= 6 RCTs with 452 surgical patients	A meta-analysis of RCTs comparing ERAS with conventional perioperative care measuring outcomes i.e. length of hospital stay, complication rates, readmission rates and mortality
	Systematic review	Hendren, (2013)	n= not identified	A systematic review of the literature for duration of catherisation in non-pelvic colorectal resection patients
	Prospective cohort study	Stubbs *et al.,* (2013)	n= 210 patients	A cohort study of patients having colorectal surgery within an ERAS programme in a hospital setting
	Retrospective cohort study	Agrafiotis *et al.,* (2014)	n= 92 patients	A single centred study implementing enhanced recovery pathway after elective colorectal resection
The bladder bundle approach (n=6)	A national comparative study	Saint *et al.,* (2013)	n= 470 infection preventionists	131 hospitals in the state of Michigan
	Uncontrolled pre-post	Oman *et al.,* (2012)	n= 2 medical and surgical units	Impact of nurse-driven interventions to reduce CAUTI rates in hospitalised patients

Uncontrolled pre-post	Titsworth *et al.,* 2012	n= 1 hospital unit	Implementation of UTI prevention bundle in a single-centred neurosurgical unit
Uncontrolled pre-post	Theobald *et al.,* (2017)	n= 99 patients	A multifaceted quality improvement strategy to reduces the risk of CAUTI on wards with veteran population
Prospective cohort study	Miller *et al.,* (2010)	n= 1953 patients	Implementation of system initiatives to reduce HAIs in a single trauma unit
Prospective cohort study	Clarke *et al.,* (2013)	n= 2228 patients	Implementation of bundled interventions to reduce CAUTI rates in a community hospital

Limiting the use of a catheter

The approach towards current practices of catheter requirement is slowly changing by limiting catheter use in the first instance. In some procedures, such as a caesarean section, the traditional routine practice was to insert a urinary catheter in all cases. A recent study recommended that caesarean sections can be managed without a catheter in suitable cases which encourages increased ambulation and early discharge with no difference in bladder volume to first urinary void (Long *et al.*, 2013). Similarly, another study suggests that routine continuous urethral catheterisation may not be necessary for patients undergoing a thoracotomy procedure or following anaesthesia (Chia *et al.*, 2009).

Education, training and feedback interventions

To address the knowledge gap, interventions have used educational sessions via face-to-face delivery or peer-to-peer education on catheter insertion, maintenance of urinary drainage systems, and general infection topics. Studies evaluating face-to-face education interventions for staff covering general infection topics and catheter management were reported with mixed results (Dyc *et al.*, 2011; Lo *et al.*, 2014). A systematic review examined the effectiveness of 21 studies (RCTs, non-randomised trials, pre and post, and cross sectional designs) that implemented behaviour related interventions in catheterised older adults to reduce E. coli bacteraemia and/or symptomatic UTIs across all care settings (Jones *et al.*, 2018). Behavioural interventions included in this review were online training on appropriate catheter insertion technique and education on catheter care with simulation training. All 21 studies were reported to be lacking methodological quality and due to heterogeneity of studies, a single effective intervention could not be recommended. However, multi-faceted education and training interventions paired with audit and feedback to catheter removal protocols facilitated reductions in UTIs and were recommended by the authors (Jones *et al.*, 2018).

A single centre study, conducted with 184 hospital based health-care workers, with a pre and post comparison design, delivered a training intervention which combined face-to-face education and standardised online training (Sundaram *et al.*, 2012). Another study with a quasi-experimental, single group, pre and post study design, combined nurses' education (n=55) with interactive face-to-face workshops on the guidance recommended by evidence-

based practice guidelines (Gordon, 2015). Both studies appeared to significantly decrease CAUTI rates in a hospital setting but were limited by their study designs.

Another study used a blended learning approach by combining feedback with education on catheter insertion and care to healthcare providers (Justus *et al.*, 2016). The feedback to healthcare providers in this study incorporated: CAUTI figures for their hospital, the consequent negative impact of CAUTIs on patient outcomes, and the resultant financial burden to their hospital. The results showed an improvement in CAUTI rates (Justus *et al.*, 2016). However, this study had an uncontrolled before and after design and was conducted in the first author's hospital with limited scope, therefore, has the potential for high risk of bias (Justus *et al.*, 2016).

A Cochrane review shows that audit and feedback can be effective to improve professional practice and healthcare outcomes in general (Ivers *et al.*, 2012). This review included and analysed 140 trials of audit and feedback that featured dichotomous outcomes, with weighted median adjusted risk difference of 4.3%. Multivariable meta-regression analysis of these studies indicated feedback to be potentially more effective when: there is low performance at baseline, it is provided repeatedly by a credible source including educational tips, has specific targets and respective action plans, and delivered in multiple forms i.e. verbal and written. The effect size varied between studies depending on the targeted clinical behaviour in the intervention. Overall, the review suggests that the feedback on individual clinical performance, benchmarked against the evidence-based standard, along with educational tips and suggested action plans, may support improvements in clinical practice (Ivers *et al.*, 2012). This might be a promising strategy for improving catheter removal, but needs more evidence of barriers and enablers to catheter removal to check if audit and feedback is fit for purpose to address the barriers/enablers identified. In addition, catheter removal was not included in any of the studies (out of 140 trials) included in this review.

Emphasis on early catheter removal

In the current literature, the emphasis has been largely on the prompt removal of urinary catheters dating back from research conducted over almost 40 years ago (Hartstein *et al.*, 1981). Studies have shown that placement of a urinary catheter for longer than 2 days postoperatively resulted in excess infections, patient suffering, cost of antibiotics, and

prolonged length of hospitalisation (Fernandez and Griffiths, 2006; Apisarnthanarak *et al.*, 2007). A systematic review of the evidence on duration of short-term urinary catheters by Fernandez and Griffiths (2006), including eight clinical trials, reported that catheters removed within 24-48 hours of insertion significantly reduced the mean length of a patient's hospital stay. An observation study by Apisarnthanarak and colleagues (2007) examined the incidence, risk factors and outcomes of inappropriately used catheters in a tertiary care hospital. The study observed 895 patients from medical and surgical wards over nine months and found urinary catheters to be inappropriately used more commonly in female, non-ambulatory and medical intensive care unit patients. Of 895 total patients, 129 patients (14%) suffered from a CAUTI and the study established that patients with longer catheter duration in comparison to shorter duration (12 vs. 3 days; $P < 0.01$) were more likely develop a CAUTI (82% vs. 8%; $P = 0.001$) which prolonged their hospital duration (median, 15 vs. 5 days; $P<0.001$). The study calculated the mean cost of monthly expenditure on antibiotics for treating CAUTIs to be US $3480 (range, $1874–$5584). Considering the benefits, a reduction in post-operative catheter duration became a key target for infection control and surgical quality-improvement initiatives in the NHS setting (Wald *et al.*, 2008).

Short versus long catheter duration

In terms of short versus long catheter duration, seven out of 11 RCTs in a Cochrane review showed earlier catheter removal to be related to fewer CAUTIs (1 versus 3 days) (pooled effect, RR 0.50, 95% CI 0.29 to 0.87) (Phipps *et al.*, 2006). Feasibility of early catheter removal particularly within 24 to 48 hours has been trialled after surgical procedures such as vaginal prolapse, anterior colporrhaphy, radical hysterectomy and ureteroscopic stone removal (Kamilya *et al.*, 2010; Huang *et al.*, 2011; Turnbull *et al.*, 2012; Kawahara *et al.*, 2013). Evidence shows that catheters can be safely removed earlier after undergoing these procedures. An RCT compared catheter removal after two versus five days following vaginal prolapse surgery. Of 246 total randomised patients, 124 were allocated to catheter removal at day two and 122 for removal at day five. The trial showed that patients in the two-day group had fewer UTIs (37% versus 22%, OR 0.5, CI 0.3–0.9, $p = 0.02$) and discharged quicker than five-day group (median 3 versus 5 days) (Weemhoff *et al.*, 2011). Another study compared catheter removal within two days to the standard duration (beyond two days), in men undergoing transurethral resection of the prostate (TURP) and found a strong correlation between early catheter removal and reduction in hospital stay (Chalise *et al.*, 2007). Collectively, the focus of these

studies was on catheter removal within 48 hours. However, where possible the emphasis is now shifting more towards catheter removal within 24 hours after surgery (Glavind *et al.*, 2007; Sekhavat *et al.*, 2008; Nygren *et al.*, 2012). An RCT compared immediate (within 24 hours; n=100) versus delayed (after 24 hours: n=100) catheter removal in 200 women following abdominal hysterectomy and laparotomy which showed a reduction in the mean length of hospital stay (2.17 ± 0.68 day vs. 2.69 ± 0.75 day, P< 0.0001), increased patient satisfaction and significantly promoted early ambulation (15.53±6.45 hour vs. 24.36±4.66 hour; P< 0.001) (Ouladsahebmadarek *et al.*, 2012) as indwelling urinary catheters can restrain early mobilisation (Saint *et al.*, 2002). In summary, early catheter removal within 24 to 48 hours of surgery has been tested safely in studies for specific procedures.

Timing of catheter removal: midnight versus early morning removal

Timing of catheter removal in terms of midnight versus early morning removal to reduce catheter duration has also been considered. Earlier studies were in favour of midnight over early morning removal (Ind *et al.*, 1993; Crowe *et al.*, 1994; Kelleher, 2002). A systematic review of eight RCTs reported midnight catheter removal reduced catheter duration and hospital stay compared to early morning (Fernandez and Griffiths, 2006; Fernandez *et al.*, 2003). However, more recent research reported no difference between voided volume and the rate of CAUTIs between catheters removed at midnight and early morning. Patients whose catheters were removed at midnight had a higher rate of re-catheterisation and it was recommended to do the catheter removal as soon as possible regardless of the time of the day/night to promote patients' comfort and sleep quality (Deitrick *et al.*, 2006). Findings and recommendations from this research are in line with the current guidance which also suggests catheter removal as soon as possible rather than waiting until midnight or early morning the next day (Loveday *et al.*, 2014).

Adaptation and changes to staffing level

Two studies reported a significant reduction in UTIs by enhancing staff levels and improved nursing hours per patient day in the hospital (Twigg *et al.*, 2011) and via the employment of Wound, Ostomy, and Continence (WOC) specialist nurses in the community setting (Westra *et al.*, 2013). Twigg and colleagues report an interrupted time series study that retrospectively analysed patient and staffing administrative data from three tertiary care hospitals (2011). In this study, a total of 10,907 nursing hours were increased over 4 years from 58,420 hours

(baseline) to 69,327 hours (at the end of 4 year period) to improve 14 nursing-sensitive outcomes including a reduction in sepsis and CAUTI/UTIs. The study by Westra and colleagues employed a comparative study design to explore the effectiveness of WOC nurse provision in the community care setting on outcomes related to agency-level staffing (2013). The study demonstrated that having the specific provision of WOC nurses is effective in achieving positive outcomes, specifically in the reduction of UTIs. Both studies identify low staffing levels to be potentially linked with prolonging the duration of catheters (Twigg *et al.*, 2011; Westra *et al.*, 2013).

Nurse-driven catheter removal protocols

The process of prompt catheter removal can be complex and lengthy. It requires daily removal assessment and a decision to remove the catheter (traditionally by a doctor) made in a timely manner once a catheter is no longer needed (Meddings *et al.*, 2010). Any steps to simplify the catheter removal process, therefore, have the potential to speed up the catheter removal. Nurse-driven protocols were implemented with predefined removal criteria that enabled nurses to make the decision as well as removing the catheter without having to obtain a removal order from the doctor. This bypasses some of the steps that were deemed to be necessary for catheter removal, saving time and speeding up the removal process (Meddings *et al.*, 2010). Catheter removal protocols and automatic stop orders to standardise urinary catheter use have demonstrated effectiveness in reducing catheter duration and reduction of CAUTI/UTI rates (Skelly, 2008; Sadeghi *et al.*, 2019; Adams *et al.*, 2012). Similar criteria were used in these three studies to predefine the indications for catheter removal protocols.

Skelly *et al.* conducted an RCT with intention-to-treat analysis in seven general medical units spread over three different Canadian hospitals (2008). The trial included a total number of 692 catheterised hospitalised patients, of which 347 were randomised into the study arm and 345 into the control arm (usual care). The criteria in this trial stipulated that pre-specified catheter removal orders should be implemented via hospital bedside charts to assess the need for the catheter's continued use. The protocol specified that the catheter should be immediately removed if a patient did not have any of the six pre-specified criteria. The criteria included: "*urinary obstruction, neurogenic bladder and urinary retention, urological surgery, the fluid challenge for acute renal failure, open sacral wound care for incontinent patients, and comfort care for urinary incontinence in terminal illness*" (Skelly, 2008, p.119). The trial concluded that

automatic stop orders significantly decreased the duration of urinary catheterisation and inappropriate catheter use. There was no difference between catheter reinsertion rates between the two groups (8.6% v 7.0%, p=0.45) (Skelly, 2008).

In another study, Sadeghi and colleagues conducted an interrupted time series analysis with the primary outcome of postsurgical UTI rates. The study employed a nurse-initiated medical directive to implement early catheter removal in the operating theatre, and the use of a standardised protocol detailing indications for both inserting and maintaining a urinary catheter (Sadeghi *et al.*, 2019). The indications for maintaining a catheter included: *"preadmission urinary catheter; urology involved in care; continuous bladder irrigation; stage 3 or 4 sacral ulcer in incontinent female patient; comfort care at end of life as per patient wishes; admitted with spinal cord injury; underwent radical pelvic surgery involving bladder (cystectomy), uterus (hysterectomy), cervix (trachelectomy) or vulva (vulvectomy)"* (Sadeghi *et al.*, 2019, Table 1). The study demonstrated a reduction in post-surgical UTIs from 2.5% (95% CI 2.0-3.1%) to 1.4% (95% CI 1.1-1.9; p=0.002) during the intervention period.

HOUDINI: The third study (Adams *et al.*, 2012) was a single centre pilot quality improvement study with the use of a plan-do-study-act (PDSA) approach, and evaluated the implementation of the HOUDINI intervention as an aid to improve patient safety. HOUDINI is an acronym for indications to continue the use for urinary catheter i.e. *"Haematuria, Obstruction, Urology surgery, Decubitus ulcer, Input and output measurement, Nursing end-of-life care, Immobility"* (Adams *et al.*, 2012, p.44). This quality improvement initiative was inspired and informed by a study presented at the Society for Healthcare Epidemiology of America (SHEA) Annual Scientific Meeting 2011 on a nurse-led protocol for the timely removal of urinary catheters (Trovillion, 2011). The intervention was piloted with a pre and post study design on non-surgical catheterised patients on three medical wards within a UK NHS based hospital. Three study wards were identified to have a high use of urinary catheters identified from the previous month's catheter prevalence audit data. The purpose of this intervention was to empower nurses to remove catheters that are no longer clinically required. In the absence of these indications, nurses could remove the catheter without having to consult the medical staff. The implementation of HOUDINI intervention reduced catheter-associated *E.Coli* positive urine samples by 70% compared to pre-intervention period (Adams *et al.*, 2012).

Reminder interventions

Reminder interventions to reduce catheter duration and CAUTI rates have been trialled in a number of different ways such as: reminder stickers on patient's clinical notes, reminders included in staff education and annual appraisal assessment, criteria-based, and computer-based electronic reminders (Bruminhent *et al.*, 2010; Smith, 2009; Baillie *et al.*, 2014; Chen *et al.*, 2013). A Cochrane review analysed 35 trials (30 RCTs, 5 non-RCTs) of reminder interventions aiming to change professional practice (Arditi *et al.*, 2017). Appraisal of the evidence in this review suggests that computer-generated reminders delivered on paper to HCPs has moderate effectiveness to improve compliance with clinical guidelines. The heterogeneity of the interventions included in this review also suggests that reminders have the potential to improve the quality of care in various settings/conditions (Arditi *et al.*, 2017), e.g. reduction in catheter duration.

Specifically in a urinary catheter setting, studies have shown that computer-based or manual catheter stop order reminders can make HCPs more aware of their patients with a catheter in-situ and can prompt timely catheter removal using daily reminders (Cornia *et al.*, 2003; Chen *et al.*, 2013). Other studies have reported the benefits of a reminder approach in reducing catheter use and duration (Loeb *et al.*, 2008; Seguin *et al.*, 2010). Loeb and colleagues (2008) reported fewer days of inappropriate and total urinary catheter use before and after the use of reminders (difference -1.69 (95% CI -1.23 to -2.15], $P < 0.001$ and -1.34 days, [95% CI, -0.64 to -2.05 days], $P < 0.001$, respectively). Seguin *et al.* (2010) analysed a total of 1271 patients, 676 in period 1 (control period) and 595 in period 2 (intervention period) with a reminder sticker on a patient's daily care sheet. Catheter duration was reported to be significantly reduced in period 2 compared to period 1 (from median=5 days, interquartile range 3-11 days to 4 [3-8] days, $p < 0.001$).

A systematic review and meta-analysis summarised the effects of reminder interventions on CAUTI rates, catheter use and the need for re-catheterisation (Meddings *et al.*, 2010). This review included 14 studies that only used reminders as an intervention with physicians or nurses for the prompt removal of urinary catheters in hospitalised adults. The intervention resulted in a reduction in the CAUTI rate by 52%, mean duration of catheterisation by 37% and no difference in the rate of re-catheterisation between intervention and non-intervention groups. This review suggested catheter reminders and stop orders should be considered to

achieve a reduction in catheter use, duration of catheterisation, and rate of CAUTIs (Meddings *et al.*, 2010). Reminder interventions help to bring the catheter removal at the forefront of HCPs' minds and reminds them to remove the catheter once it has served its purpose. Collectively, these studies show that collaborative action from staff with regular use of reminders can decrease the catheter duration by around 50%. If implemented across hospitals in the UK, this could potentially reduce the total number of days patients are catheterised from the current average of three days (Pickard *et al.*, 2012a) to close to the recommended standard of one day (Gould *et al.*, 2010). An intervention designed based on the findings reported in this thesis may have the potential to reduce CAUTIs by reducing the catheter duration by 50%. Also, the patient and family's role in providing reminders to HCPs for prompt catheter removal has not yet been explored, which may consolidate further reductions in catheter duration.

Multifaceted bundle interventions

Since the publication of epic2 and epic3 guidelines (Pratt *et al.*, 2007; Loveday *et al.*, 2014), the bundle approaches have been applied in practice as measures to reduce HAIs including CAUTIs. The multifaceted bundle approaches have included measures such as an enhanced recovery programme after surgery (ERAS) pathway and a combination of education, training, feedback, and a bladder bundle approach (Miller *et al.*, 2010) with nurse-driven catheter removal protocols (Jones *et al.*, 2018), automatic stop orders (Chen *et al.*, 2013), and reminder interventions (Meddings *et al.*, 2010). A systematic review and meta-analysis of interventional studies concluded that stop orders and catheter removal reminders to HCPs are an effective way to reduce CAUTIs in hospitalised patients (Meddings *et al.*, 2010). However, Meddings and colleagues reported that the studies included in this review were of low quality with a high risk of bias and included only one RCT (2010). The RCT included in this review was conducted with hospitalised patients (n=692) and employed a prewritten stop order for nurses to discontinue the catheter (Loeb *et al.*, 2008). The findings showed that stop orders are effective in reducing the duration of inappropriate urinary catheterisation.

The **ERAS pathway** is a quality improvement initiative which emphasises optimising patient management after surgical procedures including early catheter removal and promoting quicker discharge. Studies employing a fast-track protocol on the ERAS pathway for patients undergoing colorectal surgery confirms the feasibility of removing the catheter within 24

hours and also confirms that late catheter removal (after 24 hours) contributes to delayed hospital discharge (Nygren *et al.*, 2012; Stubbs *et al.*, 2013; Agrafiotis *et al.*, 2014). Early catheter removal has been promoted under enhanced recovery and national surgical care improvement projects. However, the early removal strategy needs to be carefully balanced against the risk of urinary retention and re-catheterisation. In a systematic review of patients with colorectal resection surgery, Hendren (2013) reported other risk factors such as abdomino-perineal resection, older age, male gender, prostate enlargement and history of urinary dysfunction to increase the risk of urinary retention, and recommended catheter removal on day six over day three. However, the author could not recommend an exact time for catheter removal intended for patients undergoing colorectal resection (Hendren, 2013). Overall, prompt removal is one of the most effective and safe ways to reduce CAUTIs, as confirmed in a meta-analysis (Varadhan *et al.*, 2010). This review included six RCTs with 452 patients undergoing major elective open colorectal surgery and compared the differences between surgical recovery outcomes from early catheter removal on the ERAS pathway with the conventional perioperative care. The results showed that the ERAS pathway seems to reduce the length of hospital stay [weighted mean difference (95% confidence interval): −2.55 (−3.24, −1.85)], and postoperative complications rates [relative risk (95% confidence interval): 0.53 (0.44, 0.64)], with no statistically significant difference in readmission and mortality without compromising patient safety.

The **bladder bundle approach** includes measures such as: limited use of catheters, aseptic insertion, maintenance of a sterile drainage system, and early catheter removal (Titsworth *et al.*, 2012) alongside continuous education and training of staff to maintain good practice (Miller *et al.*, 2010). A study compared a national sample of hospitals in the United States with Michigan state hospitals, to assess CAUTI related infection rates with and without the use of CAUTI prevention initiatives and the bundle approach (Saint *et al.*, 2013). The results showed that Michigan state hospitals had a lower rate of CAUTIs due to a greater use of prevention initiatives. The bundle approach has been demonstrated to bring benefit not only in the hospitals but in the community setting also (Clarke *et al.*, 2013).

Other components included in the multi-faceted intervention and quality improvement studies were bedside catheter reminders targeted at HCPs, staff education, and automated discontinuation orders (Theobald *et al.*, 2017). Nurse-driven protocols for catheter removal

combined with patient and family education through information flyers, were also found to be effective strategies to reduce catheter duration. Oman *et al.* (2012) demonstrate a reduction in catheter duration from 3.01 to 2.2 days (p = .018) on the surgical units and from 3.53 to 2.7 days (p = .076) on the medical units, although, the impact of patient and family education was not measured. These studies used a pre and post intervention design and reported a positive impact on improving patient outcomes in terms of reducing catheter utilisation as well as reducing catheter duration and CAUTI rates in hospitalised surgical and medical patients (Oman *et al.*, 2012; Theobald *et al.*, 2017). Educating and involving patients and their families should be an important consideration since very few interventions have aimed to support a patient or families' role in reducing catheter duration and preventing CAUTIs. This highlights an evidence gap and a deficiency in research in this area to date.

A more recent systematic review appraised the effectiveness of behavioural intervention studies aimed to reduce *E.Coli* bacteraemia and CAUTIs to make recommendations for use in clinical practice (Jones *et al.*, 2018). The range of multi-faceted intervention studies appraised in this review included audit and feedback, education, and reminders to reduce CAUTI rates. This review suggested that a single intervention could not be recommended. However, recommendations were made for the multi-faceted approach by including interventions such as providing feedback to healthcare providers in conjunction with education and catheter removal protocols, which showed promise to facilitate a reduction in CAUTI. Interventions focusing on patient education and involvement (Oman *et al.*, 2012) were recommended for further exploration and evaluation. The recommendation to incorporate feedback is also supported by a Cochrane review of audit and feedback interventions discussed earlier (Ivers *et al.*, 2012).

Despite being the main risk factor for CAUTIs, catheter duration tends to be neglected but remains a modifiable factor to be targeted by interventions (Saint *et al.*, 2005). Nursing staff have the potential to transform and develop best practice models for safe catheter care and early removal of catheters (Fakih *et al.*, 2008).

3.3.7 Summary of existing interventions

In summary, the evidence shows that there are some potentially effective interventions. Interventions applied in procedure-specific clinical contexts such as the application of a bundle approach, an enhanced recovery after surgery programme, nurse-driven protocols, and reminder systems for catheter removal have shown some degree of improvement in practice to reduce catheter duration and CAUTI rates. Audit and feedback interventions also indicate effectiveness. Therefore, it could be useful to consider a multi-faceted approach to intervention design targeted at HCPs to reduce CAUTI rates, including elements such as: reminders, education/training with audit/feedback and the means of providing feedback. In addition, educating the patients and their carers could also be considered as a possible component to target.

There is still a need to understand the implementation of the existing interventions and explore patient factors that may help to embed the effective interventions into routine care. Subsequently, successful implementation of a policy of early catheter removal in practice has not been fully achieved (Bhardwaj *et al.*, 2010; Pickard *et al.*, 2012a) and this is likely due to both patient and clinician-related factors (Wald *et al.*, 2008).

3.4 Theoretical, behaviour change and implementation research context

3.4.1 Evidence-practice gap

From the literature review of the clinical context of catheterisation, it has been established that reducing catheter duration is one of the most effective ways to reduce CAUTIs in patients with an indwelling catheter (Gokula *et al.*, 2004; Fukuoka *et al.*, 2018). It is also clear that there are barriers to implement this evidence in routine practice and achieve standards recommended in current guidance (Pickard *et al.*, 2012a; Gould *et al.*, 2010). This evidence to practice gap can be addressed using implementation research approaches, and by tackling patient and HCP behaviour-related barriers for effective implementation of interventions (Glasgow *et al.*, 2012).

Previous studies examining the reduction of catheter duration have been procedure-specific where various reasons for catheter insertion have not been considered. Reasons for catheter

insertion and ongoing use are varied (Nicolle, 2012). For example, a catheter is inserted temporarily to relieve acute urinary retention after an epidural anaesthetic, while planned insertion will be required at the time of spinal surgery to cover a period of a patient's immobilisation or in critically ill patients to monitor their urine output. Results of the procedure-specific studies may be generalisable more exclusively to the procedures included in the research. However, the common principle of early catheter removal when clinically appropriate remains. The subsequent empirical chapters four and five identify a variety of reasons why catheters are not removed in a timely manner regardless of a patient's underlying clinical condition. These reasons may potentially explain why the current average duration of catheterisation remains at three days, (Bhardwaj *et al.*, 2010; Bhardwaj *et al.*, 2012; Pickard *et al.*, 2012a) longer than the recommended standard of one day (Gould *et al.*, 2010). Training and monitoring of aseptic catheter insertion techniques have helped reduce the risk of CAUTI, but the reduction in duration of catheterisation has proven harder to implement (Wald *et al.*, 2008). It involves a change in current practice (Niël-Weise and van den Broek, 2005), requires patient and HCP behaviour change, and increased compliance with the UK guidance once it has been clarified/improved with instructions on the timing of catheter removal (Loveday *et al.*, 2014; Gould *et al.*, 2010).

Changing the behaviour of relevant individuals is important to bring about change in practice. Designing implementation interventions to change behaviour requires a systematic approach where target behaviours are specified with a clear rationale for design and explicit reporting of the intervention development process (Craig *et al.*, 2008; Fishbein and Ajzen, 1975). One way to achieve this is to use a theoretical approach to design the interventions (French *et al.*, 2012). Theory can facilitate understanding of the factors that potentially have an impact on targeted behaviours to bring about change. Clinical problems involving implementation can be robustly investigated with theoretical approaches to increase the uptake of research findings in practice (Walker *et al.*, 2003). The use of this approach can help create knowledge that can be generalised and applied in different settings to answer key questions (Walker *et al.*, 2003). A theoretical approach can help explore the causal relationships explaining the problems that are encountered in producing generalisable results, implementing interventions, and the effects produced by these interventions (Craig *et al.*, 2008). Health service research encourages the use of systems and approaches that help to translate results to the bedside as well as global health programmes (Madon *et al.*, 2007). Implementation

research is used in health services, social services, management and behavioural science (French *et al.*, 2009).

Highlighting the difference between theory-based and theory-informed approaches here is important. A theory-based approach explores problems or design interventions by explicitly using the principles of a certain theory or theories e.g. the theory of planned behaviour (Ajzen, 1991). A theory-informed approach is where the intervention design is guided by factors from single or multiple theories along with evidence around a practical problem (French *et al.*, 2012). Reflecting on evidence-practice gaps identified from the literature and guidance document review, prompt catheter removal requires a change in current practice and associated behaviours. Amongst an extensive range of theories, the current research will focus on behaviour change theories as the outcome of interest in the current research is the behaviour of patients and HCPs.

3.4.2 Advantages of a theory-informed approach

The advantages of using theoretical approaches to change behaviour have been well recognised in the literature (Michie and Abraham, 2004; Hardeman *et al.*, 2002). It is encouraged to use a theory-informed or a theory-based approach when designing research studies focusing on improving the delivery of healthcare (Brazil *et al.*, 2005). Behaviour change is vital to increase the application of evidence into routine healthcare for improved healthcare outcomes (Cane *et al.*, 2012). A clear understanding of factors around individual behaviour change is important to inform the intervention design (Health Canada *et al.*, 1999; Grol, 2001). To gain a clear understanding of these reasons it is important to know the perceived barriers and facilitators from a behavioural perspective of all parties involved (Michie and Abraham, 2004).

A theoretical approach can provide insights into clinical problems by specifying the relationships between different factors that can explain and predict behaviour (Eccles *et al.*, 2012). Data gathered using non theoretical methods may reveal whether an intervention has worked, but not *why* it worked (or reasons for its failure) (Craig *et al.*, 2008). The approach to design and implementation of existing catheter removal interventions (discussed earlier in this chapter) did not use theory-informed/based approach, which perhaps has been a key impediment to the long term sustainability of their clinical effectiveness (Improved Clinical

Effectiveness through Behavioural Research Group, 2006). Theory can also provide knowledge around circumstantial factors that influence the success of an intervention implemented in a different setting (Craig *et al.*, 2008) and provide an understanding of factors around perceptions, views and beliefs of providers (HCP) or receivers (patients) of healthcare (Ferlie and Shortell, 2001; Foy *et al.*, 2002). Furthermore, theory-based methods can help define the target behaviours, data collection, analysis and interpretation of results. Indeed, *"there is nothing so practical as a good theory"* (Lewin, 1943).

Defining the target behaviours

Target behaviour can be specified by defining the behavioural outcome and by shaping the determinants/barriers questions. For example, the TACT-A principle in terms of the 'Target', 'Action', 'Context', 'Time' and Actor (TACT-A) principle (Fishbein, 1967; Francis and Presseau, 2019). The target applies to the 'population' to be studied, action is 'a given behaviour' to be carried out by the target population, context incorporates 'within a particular setting', time includes 'specific given point in time', and actor is the 'person performing the action (Ajzen, 2005; Francis and Presseau, 2019).

Data collection: Theory can inform the approach to data collection. For example, the Theoretical Domains Framework (TDF) provides wide theoretical coverage and provides the capacity to extract a broad set of beliefs and views that could potentially enable behaviour change (Michie *et al.*, 2005).

Data interpretation: A theoretical base can facilitate data interpretation. For example, domains and constructs in the TDF are grouped to provide a coding framework for data analysis (Michie *et al.*, 2005; McSherry *et al.*, 2012).

Explanations of causes or influences: Theory-based interventions can provide understanding on how an intervention leads to behaviour change. For example, using theory to inform a theory-based process evaluation where the constructs targeted for change are assessed before and after an intervention is delivered to investigate whether changes in constructs explain changes in behaviour (Grimshaw *et al.*, 2007; Presseau *et al.*, 2016; Duckers *et al.*, 2009).

3.4.3 The Theoretical Domains Framework

The TDF provided the theoretical underpinning to this research to identify barriers and enablers to catheter duration. In 2005, using an expert consensus approach, Michie and colleagues developed an overarching psychological framework of theoretical domains (TDF), useful for implementing evidence-based practice (Michie *et al.*, 2005). The original TDF includes 12 domains with 128 theoretical constructs that correspond to each domain identified from 33 theories of behaviour change. Key constructs significant to behaviour change were indexed under 12 main domains. The definitions for each of the twelve domains are provided in Table 3.4 and construct definitions in Appendix A.

Table 3.4: TDF domains and respective definitions (Michie *et al.*, 2005)

Domain	Definition
Knowledge	An awareness of the existence of something
Skills	An ability or proficiency acquired through practice
Social/Professional role and identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting
Beliefs about capabilities	Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use
Beliefs about consequences	Acceptance of the truth, reality, or validity about outcomes of behaviour in a given situation
Motivation and goals (intention)	A conscious decision to perform a behaviour or a resolve to act in a certain way and mental representation of outcomes or end states that an individual wants to achieve
Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the environment, and choose between two or more alternatives
Environmental context and resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour

Social influences	Those interpersonal processes that can cause an individual to change their thoughts, feelings, or behaviours
Emotion	A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event
Behavioural regulation	Anything aimed at managing or changing objectively observed or measured actions
Nature of behaviours	What needs to be changed, routine/automatic/habit, and who needs to do what differently when, where, how, how often and with whom

3.4.4 Rationale and critique of the Theoretical Domains Framework

Rationale: There are several theoretical approaches to address implementation issues such as theories, models, and frameworks with conceptually overlapping constructs (Nilsen, 2015). Within evidence-based theories and models of behaviour change, some constructs differ whilst others have conceptual overlaps. e.g. TPB (Ajzen, 1991), SCT (Bandura, 1986) and HAPA (Schwarzer, 2008). Given how many different theories there are, deciding on which theory to select can be challenging (Francis *et al.*, 2012). Choosing a single or multiple theories to address the research question and then designing an intervention based on evidence accumulated through the application of a given theory(ies) may also raise uncertainties as to whether all important aspects have been covered (Francis *et al.*, 2012). For example, the theoretical construct of 'self-efficacy' is incorporated in SCT and HAPA, but SCT does not cover the 'intention' construct as such, which is one of the main theoretical constructs in both HAPA and the TPB. However, the operationalised version of SCT (Presseau *et al.*, 2014) includes a construct that is for all intents and purposes, similar to the 'intention' construct when it is tested. Nevertheless, SCT includes a construct called 'outcome expectations', while TPB labels this construct 'attitudes' which is similar. This raises an issue of using different terms for overlapping ideas, making it more difficult to decide which theory to choose; hence the benefit of using the TDF which combines constructs from different theories at a higher level.

The TDF is the combination of 128 theoretical constructs across 33 theories of behaviour and behaviour change that have been developed over a century of theory-focused research in behavioural science (Francis *et al.*, 2012). The framework provides more comprehensive coverage across key factors that may determine behaviour than any given theory, enabling researchers to proceed with a wide-ranging approach in exploratory research. This in turn helps to identify key factors to target in interventions and key theories to help design such interventions. Furthermore, if applied correctly, the TDF can help with an in-depth exploration of the interview data. This research had an interdisciplinary team with guidance and input from two health psychologists to ensure appropriate application of the TDF.

The TDF has been tested in a variety of healthcare settings primarily with HCPs and appears to be effective in producing evidence to shape future interventions (Bussieres *et al.*, 2012; French *et al.*, 2012; Tavender *et al.*, 2014). Although the use of the TDF has been relatively limited in patients in comparison to HCPs, it has been used in a few studies involving the general population. For example, testing a hand-washing intervention in a natural setting at highway service station restrooms (Judah *et al.*, 2009), fruit and vegetable intake in the adult population in an obesity pandemic context (Guillaumie *et al.*, 2010), improving the dietary behaviour of the population aged ≤13 with adaptive e-Learning (Edwards *et al.*, 2010), and in testing the effects of a cardiovascular prevention program on health behaviour and BMI in highly educated adults (Jacobs *et al.*, 2011).

Critique: Although there are many advantages of using the TDF in exploratory work, one criticism is that the framework can be perceived to be overly rigid and fixed. Critics consider that interview topic guides designed using the TDF may limit participants to only express their views and beliefs on the topic that fits around the framework (Francis *et al.*, 2012). On the other hand, inclusion of constructs in the framework is broad and unlikely to miss much compared to topic guides designed on the basis of a singular theory or no theory. Furthermore, in principle, the framework is open to expansion should new determinants of behaviour not fitting into existing domains be identified and researchers can always seek to identify such factors. A randomised study compared data collected from interviews, focus groups and questionnaires using a TDF-based guide compared with a non-theoretical approach; the study found significant overlap between the datasets (Dyson *et al.*, 2011). This exercise also showed that a TDF-based approach explored participants' beliefs around the

influence of emotional factors on behaviour which was not the case with data collected using a non-theoretical approach. Consequently, the framework offers a comprehensive approach which allows consideration of factors that may be missed when using a single theory or a non-theoretical approach.

While the TDF was designed to cover organisational and individual behaviours, those interested in organisation-level factors only may feel that the framework does not provide an elaborate approach to explore these factors. Francis and colleagues made a case that the TDF does cover organisational level factors within four of the TDF domains (Environmental Context and Resources, Social Influence, Social/Professional Role and Identity, and Behaviour Regulation) and highlighted specific constructs to address individual, team and organisational level factors (2012).

Some organisational theories focus on overall factors including the delivery of healthcare; for example, Karasek's Job Control Model (1985) focuses on factors of staff turnover, burnout, job satisfaction, and its effects on an organisation but does not focus on understanding behaviours (Karasek, 1985). These factors may have a direct impact on the problem, which is not overtly covered in the TDF, and potentially makes it less suitable for its application in a context where researchers are explicitly interested in organisational level factors. However, the main focus of the current research was to explore individual (patient and HCP) beliefs, practices, and organisational factors from the perspectives of these individuals who are working within and receiving care in an organisation rather than a standalone concept. Therefore, it was suitable for the purpose.

Despite some of the above limitations, the use of the TDF is of particular advantage in fields where little is known around the problem from a behavioural perspective (Davis *et al.*, 2015); for example, the current research area of urinary catheter duration and the reasons for prolonged catheter duration. A comprehensive theory-informed approach offered by the TDF allows exploration of a wide-ranging set of beliefs. The TDF-based interviews (with patients and HCPs) conducted in this thesis explored all of the twelve domains and constructs around barriers and facilitators to prompt catheter removal from both patient and HCP perspectives.

3.4.5 TDF application in other clinical contexts

The use of the TDF in healthcare settings has increased over the last few years. Several studies have applied the TDF in both acute and primary care settings, primarily to understand HCPs' behaviours and, in a few studies, behaviour in the general population. Some relevant examples with the use of TDF are discussed below indicating how the identified domains may inform the research reported in this thesis.

Acute setting

Beenstock and colleagues (2012) used the TDF in a study of midwives' engagement with pregnant women around providing smoking cessation advice. A TDF-based, self-completed, anonymous questionnaire was completed by 589 NHS midwives in the North East of England and 364 were included in the analysis. The results identified 11 domains of importance to provide theoretical descriptions around implementation problems to behaviours recommended in the NICE guidance on engaging pregnant women in smoking cessation consultations. These were: beliefs about capabilities, beliefs about consequences, emotions, action planning, environmental context and resources, knowledge, memory, attention and decision process, motivation and goals, social/professional role and identity, skills, and social influences. All 11 domains showed a high correlation with each other. Midwives reported high levels of motivation in four behaviours recommended in NICE guidance and acknowledged that providing smoking-cessation advice as part of their role (social/professional role and identity). Fewer certainties were expressed around the environmental context and resources available to midwives to engage in consultations with pregnant women. This study provided insight into barriers and facilitators to midwives' guideline implementation behaviours and engagement with pregnant women around smoking cessation which will guide the current practice and design of future interventions. This work supports the use of the TDF being an appropriate tool to study HCPs' behaviours and to develop implementation interventions (Beenstock *et al.*, 2012). This research informed the design of a subsequent project to develop and implement a complex intervention to increase smoking cessation in pregnant women (Bell *et al.*, 2018). Bell and colleagues (2018) tested the system-wide complex intervention in an interrupted time series analysis with economic evaluation. The results of intervention delivery showed significant increase in quitting rates (adjusted OR=1.81, 95% CI 1.54 to 2.12).

Dyson and colleagues (2011) studied barriers and enablers to hand hygiene by comparing the use of different approaches, for example, interviews (n=25), questionnaire delivery (64 distributed, 24 returned) and focus group discussions (three groups with a total of 21 participants) involving hospital-based healthcare professionals. Within each approach, two different question schedules were used, one designed using the TDF and the other without no theoretical underpinning. Results from the two approaches showed significant overlap, yet also highlighted the differences in the barriers and enablers around adherence to hand hygiene with each approach. Collectively 12 main themes with 32 sub-themes were defined. Themes of importance which identified with the use of the TDF approach to influence hand hygiene behaviour were habit or routine, emotion and incentives. These three themes were in addition to the other overlapping themes of importance identified with a non-TDF approach. Therefore, the study authors recommended the TDF to achieve a clearer and deeper understanding of the barriers and levers to clinical problems. It also supports the idea that the framework may encourage the identification of barriers that are not generally reported, yet have an impact on behaviours, especially emotion (Dyson *et al.*, 2011). This work was taken forward by the same group of researchers to further develop a theory-based instrument to improve hand hygiene practices among healthcare practitioners (Dyson *et al.*, 2013).

Another example of an application of the TDF is a parallel study carried out in two countries (Canada and the UK) by Islam and colleagues (2012) in which a cross-country comparison of intensive care physicians' beliefs around blood transfusion behaviours was conducted. The study used a TDF-based qualitative approach and interviewed 10 Canadian and 11 UK physicians. Results revealed seven domains relevant to the specified target behaviour. Four common domains identified in both the UK and Canadian studies were beliefs about capabilities, beliefs about consequences, social influences and behavioural regulation. Three additional domains were knowledge, social/professional role and identity and motivation and goals. Based on these domains, Islam et al (2012) identified potentially applicable theories and models which could be used in their future research study e.g. the theory of planned behaviour, learning theory and social cognitive theory. This work provides an example of the TDF allowing selection of an appropriate theory to design a behaviour change intervention (Islam *et al.*, 2012). French and colleagues (2012) also describe a four step methodological

systematic approach (detailed in chapter four) for developing implementation interventions to change clinical behaviours using the TDF (French *et al.*, 2012).

Primary care setting

The TDF has also been applied in a primary care research setting. This context is potentially relevant to subsequent work arising from the current research as urinary catheters are used and managed not only in the acute care setting but in the primary care setting also. McSherry and colleagues (2018) used the TDF in a study where the aim was to develop an understanding of the clinical behaviours of general practitioners (GPs) and practice nurses around human papillomavirus (HPV) practices. The target practices included initiation of a discussion of HPV infection with female patients, making an offer or a recommendation to suitable patients to have an HPV vaccine and answering patients' questions around HPV testing. Semi-structured telephone interviews were conducted with 19 GPs and 14 practice nurses. Data were analysed using content analysis and use of the TDF as a coding framework. Results showed that all 12 domains came up in the interviews but the domains most relevant to HPV testing and vaccination practices were: knowledge, emotion, social influences, environmental context, beliefs about capabilities and beliefs about consequences. The study confirmed the need to further explore this area of research and develop a future intervention, to support GPs and practice nurses in HPV management (McSherry *et al.*, 2012). Guided by the results of this interview study, the authors designed a subsequent survey study and scaled it up to include 697 primary care practitioners (McSherry *et al.*, 2018). The survey study found limitations and uncertainty in primary care practitioners' HPV infection and vaccination knowledge which hindered women's access to HPV advice. These results can inform professional educational initiatives to ensure that women have access to uniform and high-quality HPV-related information and advice (McSherry *et al.*, 2018).

Some common domains emerged in most of these studies including knowledge, beliefs about capabilities, beliefs about consequences, and social influences. It was uncertain whether these domains would arise in the empirical work reported in this thesis and whether they would be relevant from the perspectives of both HCPs (chapter four) and patients (chapter five). For example, under the 'knowledge' domain patients may not be aware of the correlation between prolonged catheter duration and increased infection risk as shown in the pilot study (Bhardwaj *et al.*, 2012). Beliefs about capabilities to sanction or perform catheter removal

amongst junior staff and more experienced staff might have differed. Similarly, for the 'beliefs about consequences' domain, junior staff may have associated re-catheterisation as a consequence of early catheter removal. Under 'social influences', patients might have been able to influence HCPs by prompting them to remove the catheter which links to the patient target behaviour in this study.

In summary, the reviewed studies suggest that the use of the TDF in the form of interviews, questionnaires and focus groups has helped understand barriers to desired behaviours. The studies also shows that the barriers and enablers identified using the TDF (Dyson *et al.*, 2011) can be taken forward to develop theory-based behaviour change interventions that can be successfully implemented in practice to target existing deficiencies in healthcare (Dyson *et al.*, 2013). Although the TDF has not yet been used in the urinary catheter setting, core domains relating to barriers that are identified in the literature suggest recurring domains of interest from similar clinical contexts.

3.5 Targeted behaviour change interventions

Systematically identified behavioural determinants can be used to design targeted interventions aimed at changing the behaviours of relevant key participants to increase compliance with required standards (Michie, 2008). However, change and adherence is seldom easy if the improvement requires complex modifications in clinical practice and behaviours, collaboration between HCP disciplines or change in the organisation of care (Grilli and Lomas, 1994; Grol *et al.*, 1998; Foy *et al.*, 2002; Burgers *et al.*, 2003). A Dutch study amongst 61 GPs, who made 12,880 decisions in contacts with patients, found that compliance was lower (36%) if recommended guidelines were vague and non-specific, incompatible with HCP's norms/values and disruptive to routine practice where a change in behaviour is required (Grol *et al.*, 1998). Enhancing adherence to the desired level requires clearly specified guidelines (Michie and Abraham, 2004) and initiatives from all dimensions involving all key stakeholders in the process (Atkins *et al.*, 2017).

3.6 Situating the present research and research rationale

Interventions designed to improve the quality of healthcare may be more successful if targeted at multiple levels including all relevant individuals involved in the process (Ferlie and Shortell, 2001) including healthcare providers (i.e. HCPs) as well as the healthcare receivers (i.e. patients) (Atkins *et al.*, 2017). However, in the context of CAUTI reduction, the existing literature focuses mainly on HCPs' perspectives. Research has not investigated both HCPs' and patients' perspectives in the same study on the topic of catheter infections. This also applies to the application of the TDF which is rarely conducted with patients and HCPs in the same research. Therefore, the focus of this thesis is on exploring both perspectives, which addresses a gap in the current literature, employing a novel approach.

There are clear benefits of patient involvement in the prevention and treatment of healthcare-acquired infections (Koutantji *et al.*, 2005). Yet many patients do not receive appropriate advice and information on the potential risks of the treatment they receive e.g. peri-operative urinary catheterisation (Bhardwaj *et al.*, 2012). More effective interventions are needed to reduce the risk of catheter-associated infections, which are potentially avoidable, and help improve patient outcomes by: patient empowerment, involvement, and participation in the modern NHS. Patient's involvement in their own care in the NHS setting is a relatively new field. Patient involvement encompasses shared decision making and gives patients a degree of control in the way they receive care (Ward and Armitage, 2012) providing the patient has the required knowledge, motivation, skills, and resources to make an informed decision. However, in contrast it can be perceived as a negative and mistrusting matter by the HCPs (Hrisos and Thomson, 2013). This could potentially be overcome by employing a collaborative approach which encourages patients and HCPs to work together (Ward and Armitage, 2012). For example, 'Shared Care' is an emerging concept in urology in men with urinary symptoms and supports patient engagement: *'no decision about me without me'* (Coulter and Collins, 2011). In another example of hand hygiene promotion, the *'Clean your hands campaign'*, patients were targeted and encouraged to take part via the use of posters and stickers with the slogan, '*It's okay to ask'* (Duncanson and Pearson, 2005). This slogan encouraged patients to remind/ask their HCPs if they had cleaned their hands before receiving care. This, in turn, assisted in collaborative working, aiming to eliminate HCPs' negative feeling that patients are

'checking up' on them (Ward and Armitage, 2012) to achieve a common goal of enhanced patient safety.

The TDF provides a theory-informed basis for exploring and investigating behaviour related implementation problems (Michie *et al.*, 2005) that can inform the development of fit-for-purpose interventions based on evidence-based theories that intend to explain and predict behaviour and behaviour change (French *et al.*, 2012). Further work is required to explore barriers and facilitators to the timing of catheter removal from both patients' and HCPs' perspectives.

Ultimately, this may help change patterns of care to reduce unnecessarily prolonged catheterisation. Thus, this study will take a dual approach using TDF-based interviews to investigate factors that affect catheter duration from both HCPs' and patients' perspective. This research will include both medical and surgical clinical areas to explore speciality-based factors. In addition to national monitoring programmes to reduce HAI in the UK NHS (Department of Health, 2007; Department of Health, 2012), this work has been prioritised in Public Health England's (PHE) recent report on strategic behavioural analyses of interventions for CAUTI prevention (Atkins *et al.*, 2019 (In preparation)). The PHE report highlights the gap in the literature stating that there is a lack of detailed investigation of barriers and enablers to CAUTI-related behaviours with the use of the TDF. The proposed research will specifically address this knowledge gap.

3.7 Conclusion

Indwelling urinary catheters are highly prevalent and typically left in-situ for longer than needed. Urinary catheters have a detrimental effect on patients in terms of causing morbidity related to CAUTIs, mortality if a CAUTI develops into sepsis, and the healthcare system via increased costs of treatment. Despite the clear evidence of catheters' detrimental effects, avoidable and prolonged use remains part of current practice. A part of the national and international initiatives include limiting the use of urinary catheters in the first place by considering alternative methods (where possible) and reducing catheter duration which has been recommended to prevent biofilm formation and resultant bacteriuria to prevent CAUTIs. Existing approaches have primarily focused on implementing interventions via a) improving

training and education of HCPs on limiting catheter use by considering alternative ways to bladder emptying such as: the use of a commode, bedpan, or urinal bottle; b) using catheters with an appropriate indications and a pre-defined criteria; and c) emphasis on reducing procedure-specific catheter duration with trial of early catheter removal within 24 or 48 hours, use of bladder bundle interventions, criteria-based stop orders/nurse-driven protocols, and manual/electronic reminders.

Although the importance of shortening catheter duration to avoid/reduce CAUTI has been ongoing for nearly 40 years, translating the evidence into routine practice in order to achieve the desired results is yet to be achieved, demonstrating an evidence-practice gap. Dissemination of the evidence around CAUTIs is, thus, insufficient to change clinical practice. Exploring ways to successfully implement prompt catheter removal is important to encourage high-quality, safe catheter care and must go beyond guideline production and knowledge provision. The current evidence base on the reduction of catheter duration is limited by reliance on cross-sectional procedure specific studies, a lack of clarity on how certain interventions succeeded to reduce catheter duration, and a lack of intervention effectiveness sustainability over time. Furthermore, the existing interventions lacked a theoretical underpinning (which undermines developing a cumulative evidence-base), focused primarily on HCPs, and did not include the patient's role or involvement in getting the catheter removed swiftly. Empirical evidence on HCP and patient-related behavioural determinants to prompt catheter removal are also lacking in the field of behaviour change interventions that can tackle this implementation issue. The current literature base would benefit from further, well designed and theoretically informed exploratory studies to identify patient and HCP related behavioural determinants (barriers and enablers) to form the foundation of a more cumulative evidence base for helping to change patterns of care and reduce unnecessarily prolonged catheterisation.

This body of research investigated patients' and HCPs' behavioural determinants of catheter duration by employing TDF-based, semi-structured interviews. TDF-based interviews will allow investigation of all domains and constructs without being selective to establish which domains and constructs are relevant to catheter duration. The identified barriers can be addressed in a behaviour change intervention for patients and HCPs to reduce catheter duration and, hence, the risk of CAUTI.

3.7.1 Selection of a theory or theoretical framework

The above examples show that there is vast scope for using a theory-based/informed approach. There are several behavioural theories that cover various aspects of the implementation process which can help researchers understand and explain how people change their behaviour (Michie, 2008). The evidence gathered can help identify the root issues driving particular problems, aid the design of interventions to tackle problems using a behavioural approach, and guide health policies and improvement of patient care delivery (French *et al.*, 2012).

Amongst many behaviour change theories and approaches, some examples include social learning theory (Skinner, 1953), theory of reasoned action (Fishbein and Ajzen, 1975), social cognitive theory (SCT) (Bandura, 1986), the trans-theoretical model (Prochaska and DiClemente, 1983), theory of planned behaviour (TPB) (Ajzen, 1991), and the health action process approach (HAPA) (Schwarzer, 2008). Collectively, these examples of behaviour change theories are used to understand behaviour and can inform the development of interventions to change behaviour which is a complex multi-factorial process (Grol *et al.*, 2007; Godin *et al.*, 2008). Individual diversity in knowledge, motivation, attitudes, social influences, and values and beliefs around cultural, organisational, and environmental factors are all potentially related to driving what determines existing behaviours and practices (Michie, 2008). Thus, identifying these factors with the use of a theory-informed method can help to develop interventions to change behaviour in the clinical setting of urinary catheters.

3.8 Link to other chapters

- This literature review identified that further qualitative research on HCPs' and patient-related behaviours to catheter duration is required. This has been advanced through qualitative work in chapters four and five.
- The review also identified a lack of clarity in national guidance on catheter removal. This is addressed throughout the thesis, with further investigation in the HCPs interview study in chapter four and discussion in chapter six.

- The need to develop a targeted behaviour change intervention to reduce catheter duration and tackle the evidence-practice implementation gap is discussed in chapter six.
- In terms of implications for future research, possible strategies for mapping the identified barriers in chapters four and five for the development of behaviour change intervention are discussed in chapter six.
- The importance of clearly specified guidelines to increase compliance has been highlighted in this chapter. This is pursued further in the discussion (chapter six) with planned steps for engagement with stakeholders and guideline makers.

Chapter 4. Barriers and enablers to healthcare professional behaviours to prompt removal of urinary catheters: A Theoretical Domains Framework-based interview study with medical, nursing and ancillary hospital staff

4.1 Abstract

Background

Combating catheter-associated urinary tract infections (CAUTIs) is a priority in the worldwide drive to reduce hospital-acquired infections. Minimising catheter duration is an effective method of reducing CAUTIs but the current median duration of short-term catheters remains higher than the recommended standard. A theoretical approach to understanding factors that may influence the implementation of catheter removal guidance may help develop effective interventions to reduce CAUTIs. This study aimed to identify barriers to guideline-recommended healthcare-professional (HCP) behaviour to prompt catheter removal.

Methods

This study involved in-depth, one-on-one, semi-structured interviews with secondary care medical, nursing and ancillary HCPs, working on medical and surgical in-patient wards, at a large teaching hospital in the North East of England. The interview guide was designed to address domains from the Theoretical Domains Framework (TDF), focusing on identifying barriers and enablers to prompt catheter removal based on HCPs' experiences. Responses were independently double-coded using the TDF as a framework. Directed content analysis informed by the TDF domains was used as the main theme labels, followed by inductively generated sub-themes within the TDF domains.

Results

Interviews were conducted until data saturation was achieved with 16 HCPs. Within the 12 domains of the TDF, two domains - *Social influences* and *Emotion* - identified barriers as well as enablers. Key barriers emerged within ten domains: poor knowledge of guidance and evidence-based practice (*Knowledge*); hierarchal decision-making (*Social/professional role and identity*); variations in current practice and guidance recommended behaviours (*Nature of the behaviour*); inability to make removal decision (*Self*) and patient's inability to manage without a catheter (*Beliefs about capabilities*); convenience, patient dependence on catheter, impact of CAUTIs (*Beliefs about consequences*); low motivation due to competing demands (*Motivation and goals*); forgetfulness, perceived low priority (*Memory attention, and decision processes*); availability of toilets and staff assistance (*Environmental context and resources*);

staff attitudes, ward culture (*Social influences*); indifference to prolonged catheter removal (*Emotion*).

Key enablers were identified within four domains: HCPs being highly skilled at removing catheters (*Skills*); use of handover notes, reminders and daily task lists (*Behaviour regulation*), senior and specialised colleagues as role models, and patient's influence (*Social influences*), and positive emotions related to job satisfaction generated by prompt catheter removal (*Emotion*).

Conclusions

This study identified a wide range of barriers and enablers for HCPs meeting recommended catheter removal practices. These barriers can inform the basis for developing a targeted behaviour change intervention to encourage prompt catheter removal as a patient safety intervention which can be evaluated across multiple sites and hospitals.

4.2 Introduction

Approximately 15-17.5% of the 14.5 million admissions to the UK National Health Service (NHS) hospitals each year (over two million people) will require an indwelling urinary catheter at some point during their hospital stay (Nicolle, 2014; Zarb *et al.*, 2012; Glynn A, 1997; Bhardwaj *et al.*, 2010). About 300,000 of these patients suffer from CAUTIs, making it one of the most common types of healthcare-acquired infection (HAI) in acute and extended care facilities (Bjerklund Johansen *et al.*, 2007). The presence of a catheter encourages the development of bacteriuria and bacterial colonisation of the bladder at a rate of approximately 5% per day (accumulative), the longer the catheter is in situ, the more the patient is at the risk of developing an infection (Gokula *et al.*, 2004; Loveday *et al.*, 2014; Fukuoka *et al.*, 2018). Subsequently, this can lead to symptomatic CAUTIs, which account for 19% of total HAIs in UK hospitals (Health Protection Agency: Public Health England, 2012), over 6% in the UK community care homes (Roberts *et al.*, 2010), and 34% in the United States of America (Fink *et al.*, 2012). In the UK, CAUTIs incur treatment costs of around £164 million annually for the NHS (Pickard *et al.*, 2012b).

Considering the high clinical and economic burden of CAUTIs, a decade ago the UK Department of Health (DoH) introduced initiatives in NHS hospitals to reduce HAIs, such as 'Saving lives' and 'Patient Safety Thermometer' to provide and measure harm free care (Department of Health, 2007; Department of Health, 2009; Department of Health, 2012). A commissioned review by the DoH identified two main risk factors for developing a CAUTI: contamination during catheter insertion and prolonged duration of catheterisation (EPIC, 2001). Placement of a urinary catheter for longer than 2 days postoperatively was subsequently shown to result in excess infections, putting patients at unnecessary risk (Pickard *et al.*, 2012a; Wald *et al.*, 2008). Reduction in post-operative catheter duration thus became a key target for infection control and surgical quality-improvement initiatives (Department of Health, 2012) such as enhanced recovery after surgery (Varadhan *et al.*, 2010; Stubbs *et al.*, 2013), nurse-driven protocols (Adams *et al.*, 2012; Fritz *et al.*, 2013), application of a bundle approach (Titsworth *et al.*, 2012; Clarke *et al.*, 2013; Saint *et al.*, 2013), and use of stop orders and criteria-based reminder systems (Chen *et al.*, 2013). Even with these initiatives, the use of avoidable catheters were reported to range from 21% to more than 50% (Caramujo *et al.*, 2011; Mikolajczak *et al.*, 2013).

Current UK Evidence-Based Guidelines for Preventing Healthcare-Associated Infections (epic3) and UK National Institute for Health and Care Excellence (NICE) Clinical Guideline 139 (CG139) and Quality Standard (QS61) (National Institute for Health and Care Excellence, 2017; National Institute for Health and Care Excellence, 2014) recommends: regular review of the patient's need for continuing urinary catheterisation and remove the catheter as soon as possible; and ensure patients and relatives are educated about their role in preventing UTI (Loveday *et al.*, 2014). There is no mention of prompt catheter removal in the '*prevention*' section of the NICE guideline on catheter-associated urinary tract infection and antimicrobial prescribing (NG113) (National Institute for Health and Care Excellence, 2018). Similarly, the European guidelines on urological infections only focus on the management of CAUTIs with antibiotic treatment and barely guides on the timing of catheter removal stating: *"the duration of catheterisation should be minimal"* (Bonkat *et al.*, 2017, p.24).

The American guidance on catheter removal and CAUTI prevention are produced by the Centers for Disease Control and Prevention (CDC) in conjunction with Healthcare Infection Control Practices Advisory Committee (HICPAC) (Gould *et al.*, 2010). The CDC guidance is more specific regarding the timing of catheter removal, suggesting: *"for operative patients who have an indication for an indwelling catheter, remove the catheter as soon as possible postoperatively, preferably* ***within 24 hours****, unless there is an appropriate indication for continued use"* (Gould *et al.*, 2010, p.10). The evidence used in the development of the UK epic3 guidance is based on the American CDC HICPAC guidance (Loveday *et al.*, 2014, p.S31). But it does not specify the timing of catheter removal as the American guidance, which can be open to subjective interpretation, indicating a shortcoming in the UK guidance.

There is a growing body of evidence in support of the safety and feasibility of early catheter removal particularly within the 48 hours post-insertion. It has been safely trialled in patients undergoing a range of different surgical procedures. For example, vaginal prolapse surgery (Kamilya *et al.*, 2010; Weemhoff *et al.*, 2011), colporrhaphy (Huang *et al.*, 2011), hysterectomy (Turnbull *et al.*, 2012), ureteroscopic stone removal (Kawahara *et al.*, 2013), and transurethral resection of the prostate (Yu *et al.*, 2018). These studies demonstrate the feasibility of early catheter removal without adding any significant morbidity such as the risk of re-catheterization or haemorrhage, while reducing the incidence of CAUTIs and shortening hospital stays. However, this scenario may not be feasible in complex surgical procedures

where patients are required to be completely immobilized post-operatively e.g. spinal fixation or patients on the Critical Care/Intensive Care Unit after surgery. But early removal in the majority of the uncomplicated surgical cases should be feasible within 48 hours. A trial without a catheter (TWOC) within this period should also be considered when clinically appropriate (Cheng and Chin, 2016; Emberton and Fitzpatrick, 2008). A Cochrane review (detailed in chapter three) of randomised controlled trials (RCTs) demonstrated that early catheter removal (1 day) versus late (3 days) in post-operative patients related to fewer CAUTIs (RR 0.50, 95% CI 0.29 to 0.87) (Phipps *et al.*, 2006), whilst in support of this review, other studies showed catheter duration longer than 2 days postoperatively results in excess catheter infections (Apisarnthanarak *et al.*, 2007; Fernandez and Griffiths, 2006). A strong correlation was also found between early catheter removal and reductions in hospital stay (Chalise *et al.*, 2007). Despite this evidence, the UK clinical guidance by epic3 and NICE does not provide any time parameters for catheter removal.

Collectively, the evidence supports removal within at least 48 hours. However, increasingly the emphasis is now shifting towards catheter removal within 24 hours after surgery, where possible (Sekhavat *et al.*, 2008; Nygren *et al.*, 2012; Glavind *et al.*, 2007). Studies compared immediate (within 24 hours) versus delayed (after 24 hours) catheter removal following abdominal hysterectomy and laparotomy and demonstrated a reduced length of stay, increased patient satisfaction and earlier ambulation (Long *et al.*, 2013; Ouladsahebmadarek *et al.*, 2012). The guidelines by the Enhanced Recovery after Surgery (ERAS) Society also recommend catheter removal within 24 hours for postoperative patients undergoing gynaecologic/oncology surgery (Nelson *et al.*, 2016).

In summary, early catheter removal within 24 to 48 hours of surgery has been tested safely in studies for specific procedures. However, despite the evidence, guidance to promptly remove catheters has proven harder to implement in practice (Niël-Weise and van den Broek, 2005). This may be due to patient and HCP related factors such as inadequate knowledge, training, and lack of monitoring of catheter duration and CAUTI incidence (Willson *et al.*, 2009) and potentially because the UK guidance does not provide specific guidance on the timing of catheter removal.

As per the UK guidance, daily catheter removal assessment with appropriate documentation in patient notes is paramount to the timely removal of catheters (Loveday *et al.*, 2014). A daily assessment helps to establish an appropriate indication for the catheter's continued use based on identified criteria such as: haematuria, obstruction, urological surgery, decubitus ulcer, input and output measurement, nursing end of life care, and immobility (Adams *et al.*, 2012). However, practice audits have shown that catheter removal assessments do not get carried out on a daily basis (Bhardwaj *et al.*, 2010). This may contribute to the continued prolonged postoperative median catheter duration in some UK hospitals (Pickard *et al.*, 2012a). There is thus clearly a gap between the implementation of evidence and guidelines into clinical practice.

To address this implementation problem and change current practice, it is first important to understand the determinants of HCP behaviour (i.e. barriers and enablers) related to catheter removal practice (Lo *et al.*, 2014; Meddings *et al.*, 2010; Craig *et al.*, 2008; Wilde *et al.*, 2013; Bhardwaj *et al.*, 2012). The identified barriers can then be addressed in a behaviour change intervention designed specifically with solutions fit for purpose (Craig *et al.*, 2008; Wilde *et al.*, 2013) as demonstrated by French and colleagues in a step-wise manner (French *et al.*, 2012).

The use of theoretical approaches for designing and evaluating complex interventions continues to be emphasised. Guidance by the UK Medical Research Council highlights the necessity for developing a theoretical understanding of the likely process of change; and outlines that "*best practice is to develop interventions systematically, using the best available evidence and appropriate theory*" (Craig *et al.*, 2008, p.2). Intervention design that incorporates the use of theory enhances understanding of what interventions work, and why, and helps to promote the uptake of evidence into practice (Johnson and May, 2015; Eccles *et al.*, 2005).

The TDF was developed by integrating 128 theoretical constructs, from 33 theories of behaviour change, developed over a century of research and organised into 12 domains (Michie *et al.*, 2005). The definitions for the TDF domains and constructs have been provided in Table 3.4 (chapter three) and Appendix A, respectively. The TDF has been operationalised using interview, questionnaire and focus group methods. It has been used in a variety of clinical settings to understand behaviour-related barriers and enablers to implementing

recommended standards in practice. A few examples of clinical settings in which the TDF has been applied include: physical activity in overweight and obese pregnant women, clinician blood transfusion behaviours, diagnostic imaging, and hand hygiene behaviours (Flannery *et al.*, 2018; Schwendicke *et al.*, 2018; Gramlich *et al.*, 2017; Francis *et al.*, 2012; Taylor *et al.*, 2013). It provides a basis for organising modifiable factors that may link to behaviour in healthcare settings and to relate these to behaviour change theory.

The TDF supports a systematic approach to developing and evaluating theory-informed behaviour change interventions to implement evidence into practice (French *et al.*, 2012). French and colleagues propose a four-step approach; firstly, identify the problem in terms of defining target behaviour as per the TACT-A principle (Target, Action, Context, Time and Actor) (Francis and Presseau, 2019) i.e. who needs to do what differently and when (described in methods section). Secondly, assess barriers and enablers using a theoretical framework. Thirdly, develop the intervention and select the delivery mode informed by findings from the second step by identifying behaviour change techniques to overcome modifiable barriers and enhance the enablers. Finally, in step four, process and outcome measures are selected to measure and understand the change in behaviour.

Underpinned by the TDF and encompassing the first two steps of the French model described above, the current study has two main objectives. These were to 1) identify the enablers, and 2) the barriers to prompt catheter removal practice pathways that may influence change in HCP clinical behaviour.

4.3 Methods

This was a single centre, semi-structured interview study, using one-on-one interviews informed by the TDF. The study has been reported per consolidated criteria for reporting qualitative research (COREQ) (Tong *et al.*, 2007).

4.3.1 Specifying the target behaviour

Literature linked to psychological theories to develop behaviour change interventions recommends taking a systematic approach to specifying the behaviour of interest as the first step (French *et al.*, 2012). The study target behaviour was defined in terms of TACT-A principle

including Target, Action, Context, Time and Actors (Francis and Presseau, 2019; Fishbein, 1967). TACT-A was specified with the use of current guidelines on the prevention of CAUTIs (detailed in the introduction section) and a consensus panel including a range of professionals (professor of urology/consultant urologist, scientist/health psychologist, nurse consultant in continence care, urology nurse specialists and senior urology research nurse). In the study specific TACT-A, the 'Target' of the behaviour was 'patients requiring a short-term catheter with planned duration of ≤14 days'; the 'Action' was 'removing the catheter as soon as it was no longer needed for patients under their care'; the 'Context' was 'peri and postoperative drainage of bladder, bladder irrigation, monitoring urine output, acute illness or urinary retention'; the 'Time' was 'within 24 hours of insertion'; and the 'Actors' were 'medical, nursing and ancillary HCPs working on medical and surgical wards'.

4.3.2 Development and piloting of interview schedule

The interview schedule was developed with the use of sample questions outlined for the TDF domains and constructs (Appendix B) to support the development of the TDF-based interview schedule (Michie *et al.*, 2005). The sample questions were then adapted for the current clinical setting around urinary catheters and the TACT-A principle above (Appendix C). The interview schedule incorporated supplementary prompts where necessary. Multidisciplinary consensus discussions with the Decision Making and Organisation of Care (DMOC) Group and Newcastle Health Psychology Group, critiqued the draft study protocol and interview schedule. The feedback received from experts in the field was integrated into the design.

The draft interview schedule was then pilot tested with three HCPs (surgeon, staff nurse and a healthcare assistant) to assess perceived face validity, acceptability, the flow of interview questions and completion duration. The pilot interviews confirmed that surgeons are mainly involved in making the decision and writing catheter removal orders rather than doing the removal procedure. This was reflected in the schedule with a question '*Is removing a catheter part of your role*?'. Following another suggestion, a cue card was made available to HCP participants during the interviews, which displayed the 'action' from the TACT-A principal (described above in section 4.3.1) that was being asked about in the interview questions. The text displayed on the cue card was 'removing the catheter as soon as it was no longer needed for patients under their care'. The purpose of this was to minimise repetition and asking lengthy interview questions in order to improve the flow of the interview.

4.3.3 Sample size and data saturation

The sample size was estimated to be within 20 interviews with the '10+3' rule applied to reach thematic saturation (Francis *et al.*, 2010). This approach holds that interviews are conducted with at least 10 individuals in the first instance and that evidence of data saturation can then be claimed when three subsequent consecutively interviewed individuals do not raise any new issues (stopping criterion). If new themes are still emerging, additional participants are interviewed until three consecutive participants do not bring up new themes.

4.3.4 Setting and participants

Participants were HCPs working on medical and surgical in-patient wards in a large secondary care UK NHS teaching hospital in the North East of England hosting 1800 beds. The participants were recruited to seek quotas of respondent types according to the eligibility criteria. The eligibility criteria comprised of:

- HCPs from professional backgrounds including medical, nursing and ancillary healthcare assistants
- HCPs working on medical or surgical wards
- HCPs involved in all aspects of catheter care and removal practices.

To encompass a broad range of viewpoints, HCPs with the senior and junior levels of professional experience and varied length of service were included in the study. Different shift patterns were also covered to explore any factors related to catheter removal that may be affected by shift working.

4.3.5 Recruitment procedures and data collection

All activities related to recruitment, consent, interviews and analysis were conducted by Rashmi Bhardwaj-Gosling (RBG). The interviewer's background is in the fields of nursing and clinical research (Masters in Clinical Research). The interviewer has relevant credentials and training to conduct interviews with a healthcare professional group and to obtain informed consent as per the ICH GCP (good clinical practice) code. Interviewees were made aware of this before the start of the interview. The researcher and participants were not known to each other before study participation.

Before study recruitment, medical and nursing senior departmental leads (clinical directors, directorate managers and matrons) were approached via emails and made aware of the study. Meetings were then arranged in-person to negotiate departmental support for study recruitment. Senior leads were in support of the study and agreed to relieve staff, who were willing to take part in the interviews, during their work time. The support arrangement was conditional on the participant's shift being covered for the time they were away from the ward. The support arrangement was cascaded down to the ward managers by departmental matrons via email.

During the recruitment period, participants were approached face-to-face by RBG on wards and invited to take part in the study. To ensure HCPs' exposure to catheterised patients, medical and surgical wards were included where patients with short-term urethral catheters were routinely admitted. This was because some wards do not have catheterised patients, e.g. orthopaedics surgery wards primarily conducting hand surgeries, and other wards only have patients with long-term catheters, e.g. neurology rehabilitation. Recruitment materials included a study poster which was displayed widely on the wards (Appendix D). In addition, RBG delivered formal and informal study awareness talks regularly at staff meetings. The content of talks covered the study background, aims, eligibility criteria, invitation to participate and explanation of what taking part would involve. Participants were approached and recruited without the involvement of their ward manager to avoid social pressure and possible perceived coercion. Eligible and interested participants were provided with the participant information sheet (PIS) (Appendix E). Written informed consent was obtained for participation and to audio record and transcribe the interview verbatim (Appendix F). The voluntary nature of the study participation and choice to opt out at any time was explained in the PIS and reiterated during the consent process. Interviews were conducted at a later stage when an arrangement was made for participants to be relieved from their clinical duties.

Audio recording began after initial introductions between the interviewer and the interviewee were completed to avoid capture of identifiable information. Participants were reassured about the confidentiality of their interview content both verbally and in writing, as detailed in the PIS and consent form. Participants were also made aware that the revelation of any malpractice issues detrimental to the safety of the concerned individuals would be reported to the appropriate manager and dealt with according to hospital policy. This was also detailed

in the PIS. Interviews were conducted at the participant's workplace away from the ward environment to minimise disturbances, and with only the participant and researcher present. A casual atmosphere was kept throughout to maintain the flow of the conversation.

4.3.6 Data management and analysis

Audio recordings were anonymised with the participant's unique study number and transcribed verbatim by an external company (UK Transcription). The content of the transcripts was checked before the analysis. This was to maintain the anonymity of any identifiable data that may have been recorded during the interviews. To enable coding, transcriptions were imported into an NVivo project using NVivo qualitative data analysis software version 10 by QSR International Pty Ltd. (Richards, 2005). All transcripts were securely saved on the Newcastle University IT server.

The interview data was analysed using a deductive approach (directed content analysis, Wildemuth, 2016) for initial coding using the TDF as an analysis framework and then used an inductive approach to identify emergent sub-themes within each TDF domain related to barriers and enablers to prompt catheter removal. Out of three approaches to content analysis, the directed content analysis was the most suitable approach for the study (Hsieh and Shannon, 2005) as it allowed a deductive approach to analysis with the use of an existing theoretical framework, in this instance the TDF (Vaismoradi *et al.*, 2013; Mayring, 2000).

The study analysis was conducted in three main stages. In the first stage, statements were coded at the domain level by RBG with the use of 12 pre-defined TDF domains as *a-priori* themes (Ryan and Bernard, 2003; Elo and Kyngäs, 2008). Similar responses in the transcripts were grouped into each of the 12 relevant TDF domains with certain statements double coded in two different domains (Patey *et al.*, 2012). Multidisciplinary consensus discussions critiqued the emerging analysis in regular data clinics held with the wider research team.

In the second stage, collective responses in each domain were cross-checked by an independent secondary coder Dr Suzanne McDonald (SMc) at the domain level to confirm the integrity of the initial coding process. SMc is a health psychologist with expertise in TDF-based interviews. At the end of the cross-checking process, the secondary coder provided a summary of agreements and disagreements. Differences in coded responses were discussed in-person

by the primary and secondary coder (RBG & SMc) to reach consensus. On occasions where a consensus could not be reached, the responses were agreed to be double coded. A summary of coded differences and agreements between the primary and secondary coder has been provided in Appendix G.

In the third and final stage, sub-themes were inductively generated by RBG and cross-checked by Dr Samuel Ginja (SG). SG is a health psychologist with expertise in behaviour change methods and TDF-based interviews. Similar sub-themes were merged and results nested under relevant TDF domains by RBG, to clarify the barriers and enablers particular to prompt urinary catheter removal within TDF domains (Braun and Clarke, 2006). It was planned that if additional factors arose that did not fit in the TDF, an open approach to coding would be taken.

4.3.7 Ethical and institutional approvals

The research study was approved collectively as part of the REDUCE project (reducing the urinary catheters including patient and healthcare professional studies) by a UK NHS Research Ethics Committee (reference number 13/WM/0460) and by the host institution (reference number 6649) along with approval from the Ethics Committee at Newcastle University. The study was adopted to the National Institute for Health Research (NIHR) Clinical Research Network Portfolio (reference 15750) and approved by the host organisation's Caldicott and Data Protection Guardian team.

4.4 Results

4.4.1 Sample characteristics

Sixteen participants meeting the eligibility criteria were interviewed and included in the analysis (see Table 4.1). Three participants were male and thirteen were female due to the majority of nursing staff being female. The participants were from a wide range of medical, nursing and ancillary professional backgrounds. The medical staff included doctors (n=2), ancillary staff (n=2), and nursing staff (n=12); the nursing sample comprised of junior and senior staff nurses (n=9), a ward sister (n=1), a clinical nurse specialist (n=1) and an enrolled nurse (n=1). The participants were recruited from medical (n=8) and surgical (n=8) wards, were employed full-time (n=13) or part-time (n=3), and were involved in caring for patients with urethral catheters and their removal. Participants' professional experience ranged from

0.2 years (8 weeks) to 32 years (median=5 years). Interviews lasted an average of 66 minutes (range: 39-120, median=58).

Table 4.1: Characteristics of healthcare professional participants

Participant	Gender	Professional title	Speciality	Professional experience (years)	Hours of work [i]
1	Female	Clinical Nurse Specialist	Surgery	6	Full time
2	Female	Ward Sister (Manager)	Surgery	25	Full time
3	Female	Enrolled Nurse	Surgery	32	Full time
4	Female	Registered Nurse	Surgery	10	Part time
5	Female	Healthcare Assistant	Surgery	15	Full time
6	Female	Registered Nurse	Surgery	1	Full time
7	Female	Registered Nurse	Surgery	0.15	Full time
8	Female	Registered Nurse	Medicine	25	Part time
9	Female	Registered Nurse	Medicine	0.2	Full time
10	Male	Registered Nurse	Medicine	19	Full time
11	Female	Registered Nurse	Medicine	7	Full time
12	Female	Doctor	Medicine	1	Full time
13	Female	Healthcare Assistant	Medicine	6	Part time
14	Male	Doctor	Medicine	2	Full time
15	Female	Registered Nurse	Surgery	3	Full time
16	Male	Registered Nurse	Medicine	19	Full time

[i] Full time (≥37.5 hours), part time (≤ 30hours)

4.4.2 Data capture and saturation

Interviews were conducted from February to August 2014. Ten interviews were conducted in the first instance, followed by two sets of three interviews in each round. Data collection was ceased after 16 interviews (10+3+3) when the saturation point was reached and participants did not raise any new themes at the domain level. None of the statements in the dataset appeared to be irrelevant and did not fit within the TDF domains.

4.4.3 Key sub-themes identified within relevant TDF domains

Related to study objectives, specific beliefs were identified within each of the 12 TDF domains (*a-priori* themes). The results are presented within respective domains under two main categories of barriers and enablers to prompt catheter removal. These included an appraisal of current catheter removal practices followed locally in relation to current guidance; a background to HCPs' understanding of local, national and international guidance on catheter removal; different professional groups' contribution to catheter removal practice; and additional barriers and enablers perceived by HCPs to prompt catheter removal practice. There was a cross-over between two domains where a domain identified both barriers and enablers.

Research objective 1: Barriers to prompt catheter removal practice

The barriers to prompt removal were reflected in ten domains. These were: *Nature of the behaviour; Knowledge; Social/professional role and identity; Beliefs about capabilities; Beliefs about consequences; Motivation and goals; Memory, attention and decision processes; Environmental context and resources; Social influences;* and *Emotion*. A conceptual map of domains and sub-themes representing barriers related to this research objective has been illustrated in Figure 4.1.

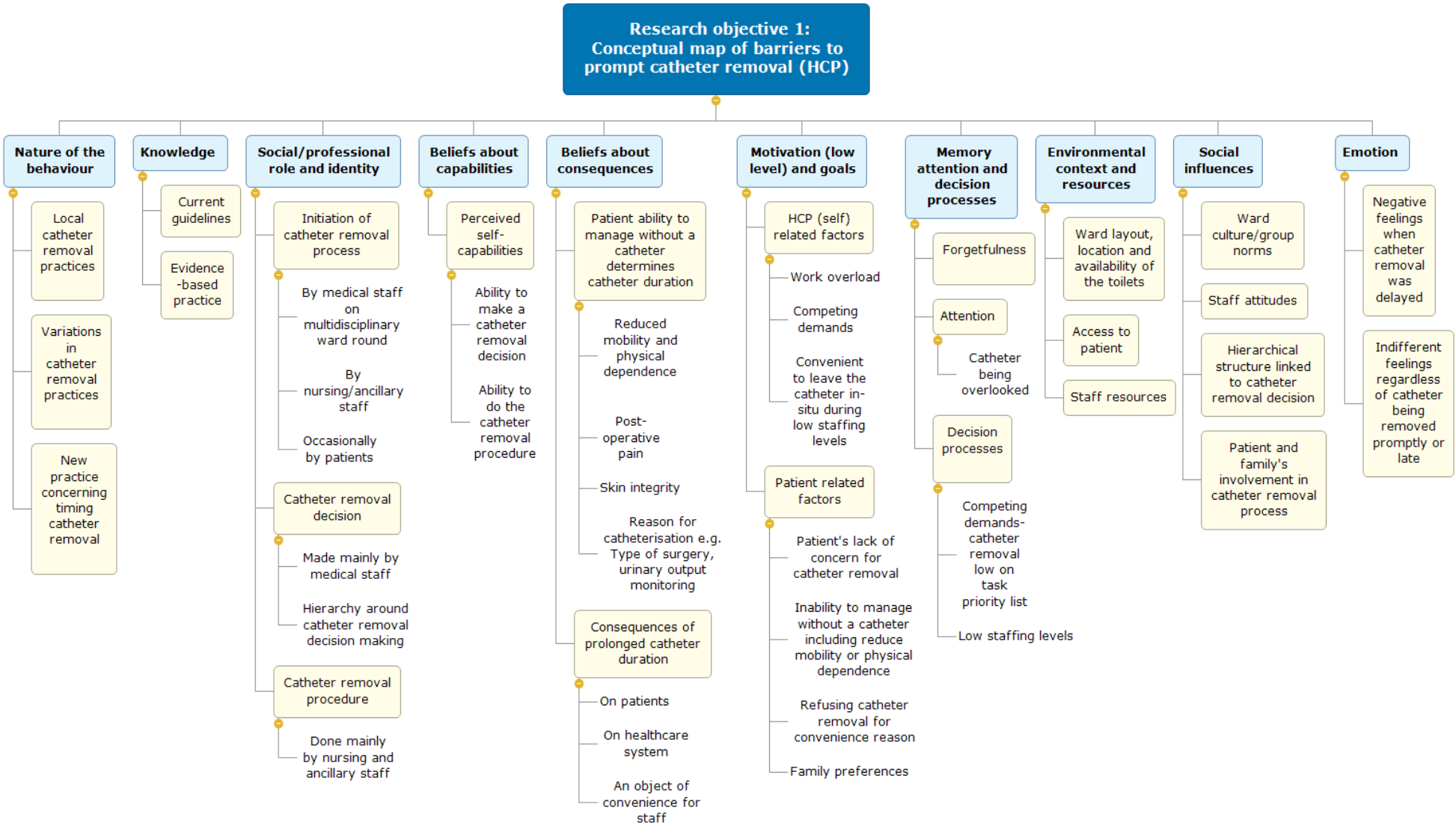


Figure 4.1: Conceptual map of healthcare professional barriers to prompt catheter removal practice

Nature of the behaviour

Descriptions of current urinary catheter removal practices followed locally, and variations amongst these practices across the different wards were coded within the *Nature of the behaviour* domain. Three sub-themes emerged within this domain:

Sub-theme 1: Local catheter removal practice is noncompliant with guidance

Current catheter removal practice is deemed non-concordant with NICE/epic3 (Loveday *et al.*, 2014) and CDC guidance (Gould *et al.*, 2010) which advises that catheters are routinely assessed on a daily basis or removed within 24 hours of insertion.

"If we think about it, then we do the assessment to see if it can come out on the ward round, but it doesn't always happen on a daily basis" (nurse, HCP16).

"Removing the catheter within 24 hours only happens very rarely on this ward. It's not routinely done unless a patient's pulled it out themselves" (healthcare assistant, HCP13).

"I wouldn't say that it's a routine practice yet, no" (nursing ward manager, HCP02).

"No, it's certainly not routine on this ward to remove the catheter within 24 hours" (doctor, HCP12).

Participants reported that there was no local guidance on the timing of catheter removal which was perceived as a barrier and the majority were unaware of the national or CDC guidance.

"*We don't have local guidance on when to remove a catheter. I'm not actually sure if there is any guidance on this nationally either*" (nurse, HCP06).

Catheter removal assessments ware described as being done on a case-by-case basis, by considering factors such as mobility and reason for catheterisation. Once the indication for catheter removal is established, it was reported that catheters are removed either on an ad-

hoc basis or unsystematically by following different patterns concerning the timing of removal, described in the next section (sub-theme 2: variations in catheter removal practices).

"The catheter duration can vary. There's never a definite guideline here, it tends to be removed on an individual basis if somebody's up and about then it tends to come out. Really it's down to the individual patients" (nurse, HCP 16).

Some participants felt that patients admitted to the Emergency Assessment Unit can be unnecessarily catheterised. They expressed that when a patient is transferred from the Emergency Assessment Unit to a ward, there is generally no documented reason for catheter insertion or indication for discontinuation in patient's clinical notes which can cause a delay in catheter removal.

"*Sometimes we* (ward nursing staff) *feel that catheters are put in unnecessary when you receive patients from the Emergency Assessment Unit, with no indication of when it should come out in the patient's notes. Then you have to spend hours on the phone trying to ring around to find out why it was put in the first place and when it can come out"* (nurse, HCP11).

Sub-theme 2: Variations in catheter removal practices among different wards

Variations in the timing of catheter removal practices were reported over different shift patterns and times on different wards. Participants on certain wards reported that they removed catheters soon after the catheter removal decision was made, whilst other wards followed a specific pattern for removal at either midnight or 6 am the next morning which can be several hours after the release of the catheter removal order. The nursing staff were aware of the rationale for catheter removal at midnight but unaware of the rationale behind early morning catheter removal. No local policy within this hospital suggests removing the catheter at midnight or early morning; this conforms to neither national nor international guidance. It was also described as non-standardised practice.

"Midnight vs 6 am removal depends on the ward and surgeon's preference, and it depends on the operation that they've had done. Mostly the TURPs tend to be removed at midnight. The rationale behind that is so that the patient will just go back to sleep and then they get up in

the morning, they'll just have a normal wee. I'm not sure the rationale behind the 6 am removal" (nurse, HCP01).

"The practice of removing at midnight or in the early morning is not very standardised" (healthcare assistant, HCP05).

A lack of explicit catheter removal instructions (removal order) in patients' post-operative notes, written by the surgeon, and specific information on 'when' the catheter should be removed were also perceived as contributory factors which cause a delay in catheter removal. The nursing staff claimed to be following medical staff members' orders (as per a consultant's preference) for catheter removal, however their lack of autonomy and involvement in the decision-making process was considered as a barrier.

"With the midnight and 6 am removal practices, sometimes catheter doesn't come out almost 24 hours later from the doctor giving the catheter removal order. We're happy to take it out whenever they want it out but if they don't specify a time, then it's generally 6 am the next day" (nurse, HCP11).

"The duration of a catheter can depend on consultant's preference" (nursing, ward manager, HCP02).

Sub-theme 3: New practice concerning the timing of catheter removal

A relatively new practice was reported by the participants on urological surgery wards, where patients were reported to be discharged home with a short-term catheter in-situ after having a surgical procedure. HCPs seemed to conclude that this practice was helpful to reduce the length of the patient's hospital stay which, in turn, freed-up the bed space to take on new patients from waiting lists.

"The incentive to sending patients home with a catheter is to get them home quickly and make more room for future patients" (enrolled nurse, HCP03).

They also explained that sometimes this had an unfavourable effect on catheter duration due to the workload of the 'trial without a catheter' (TWOC) clinic. In the TWOC clinic patients are scheduled to return to have their catheter removed in an outpatient setting after being discharged home.

"Sending patients home with a catheter in order to reduce the length of hospitalisation sometimes isn't always the right thing to do, because it increases the catheter length, on the other hand, it increases the risk of infection especially when TWOC clinics are full to get the catheter out" (nursing ward manager, HCP02).

Knowledge

Two sub-themes were generated within the knowledge domain that represented barriers to prompt catheter removal. The participants' accounts demonstrated a considerable variation in knowledge regarding local and national catheter removal guidelines and inconsistencies around knowledge of evidence-based practice in support of prompt catheter removal.

Sub-theme 1: Lack of knowledge of current guidelines

Generally, there was little awareness of national guidance by the UK NICE/epic3 (Loveday *et al.*, 2014) or American CDC guidance (Gould *et al.*, 2010) on urinary catheters.

"I wouldn't say I am familiar with any specific national guidelines around catheter removal" (doctor, HCP12).

Those participants who were familiar with the national guidance perceived the statements to be vague with no specific instructions on the timing of catheter removal. Participants described that the local guidance focuses on catheter insertion and removal procedures but does not cover when the catheter should be removed.

"Sometimes when you've got grey areas due to lack of clarity in guidelines, it just becomes confused and open to a person's own subjectivity" (healthcare assistant, HCP13).

"There are local procedural guidelines for inserting and removing catheters, but not on when to remove them" (nurse, HCP07).

Sub-theme 2: Lack of knowledge of available evidence-based practice in support of prompt catheter removal

Specific microbiology knowledge around the development of catheter infections varied between medical and nursing professionals. None of the nurses interviewed knew about the catheter duration and its relation to forming bacterial biofilms as each day passes. Nurses explained that the subject of microbiology is not covered in the nurse training curriculum or the in-house training related to urinary catheters.

"*We didn't get taught anything around microbiology of catheter infections in my nurse training, no. I can't say*" (nurse, HCP15).

Doctor participants were aware of the biofilm development but unaware that every day increases the patient's risk of developing infections at 5% per day.

"*With time you develop a biofilm inside the catheter from colonising bacteria inside the catheter track. The longer the catheter's there, the more extensive the colonisation will become, and the greater the risk of bacteraemia in urine causing infection*" (doctor, HCP14).

Social/professional role and identity

Barriers coded to this domain suggested that there are three aspects to the catheter removal process concerning different professional roles: initiation of the catheter removal process (including removal assessment), the catheter removal decision-making process, and subsequently performing the removal procedure. The ancillary staff described the hierarchical structure around catheter removal process i.e. from doctors to nurses to ancillary staff.

Sub-theme 1: Initiation of the catheter removal process

The participants reported that the catheter removal process can be confirmed by medical staff (on routine ward rounds) but is often initiated by nurses and ancillary staff. Occasionally patients ask about their catheter removal also.

"I have never made catheter removal decision on my own but we discuss it with the doctors at the ward rounds generally" (nurse, HCP11).

"Patients do ask sometimes if their catheter can come out but not all of them ask. When they do, you think about it and that's a good thing. So that could be another thing; educating patients to get involved, also" (doctor, HCP14).

Sub-theme 2: Catheter removal decision

The participants described a hierarchical structure to the catheter removal decision process where the decision is primarily associated with a role specific to medical staff. However, experienced/senior nursing staff reported that in straightforward cases they can make the catheter removal decision without consulting a doctor. Although, general role perceptions were that nurses do not make the catheter removal decision and junior doctors wait for a senior medical consultant's approval before making the final decision.

"Until things and protocol changes, and surgeons start leaving the decision to remove the catheter more to us (nurses), then fine. It's a great feeling to be able to go to the patient and say, "I'm happy with that, now I'm going to take that out". It will avoid unnecessary delays" (enrolled nurse, HCP03).

"Through experience, I would know when to remove the catheter. On some of the wards, they've got a few new members of nursing staff who might not know this" (nursing ward manager, HCP02).

"Sometimes there's a junior doctor who's not too sure whether they should take it out of not, so you're waiting to confirm it with the consultant. Obviously then you get senior reviews (ward

round) *only twice a week here on medical wards, that's when you get an opportunity to discuss the catheter with the senior consultant"* (doctor, HCP12).

"Well, when I was working on medical wards as a junior doctor, the consultants pretty much decided everything on the ward round with rest of the team present. If a patient's catheter was ready to come out, you would just wait until the next ward round to discuss it. You wouldn't contact the consultant specifically to discuss a catheter removal. Now I come to think of it, sometimes it added up to three days to patient's catheter removal with no legit clinical reason" (doctor, HCP 14).

Sub-theme 3: Performing catheter removal procedure

The removal procedure is performed mainly by the nursing and ancillary staff.

"Catheter removal decision follows from doctors to nurses then to us who mostly remove the catheter" (healthcare assistant, HCP05).

Beliefs about capabilities

The participant's beliefs about their capability regarding catheter removal were described to have two aspects: 1) the ability to make the catheter removal decision, and 2) the ability to do the catheter removal procedure. The first aspect had some overlap with the *Social/professional role and identity* domain (reported above). The hierarchical structure (*Professional role identity*) affected junior staff members' confidence and ability to make a catheter removal decision. The skill to remove the catheter is reported in enablers sections (*Skills* domain) as professionals from all backgrounds reported to be highly skilled in the catheter removal procedure.

Sub-theme 1: The perceived capability to make a catheter removal decision

Although HCPs from all different professional backgrounds reported being highly skilled at removing urinary catheters, the capability to make a catheter removal decision varied between medical and nursing HCPs. In this hospital organisation, the catheter removal order can be initiated by the nursing or ancillary staff but the final confirmation mainly comes from the medical team. Nurses perceived it to be firstly, a capability issue to make the catheter

removal decision and secondly, a confidence or professional identity/social influences issue to approach senior medical staff for a catheter removal order. The perceived level of confidence varied depending on their professional experience and 'to whom' they had to approach on the medical team i.e. consultant (senior physician/surgeon), specialist registrar, or the junior doctor. The more junior the staff, the less confident they reported being in approaching the senior medical staff to obtain a catheter removal order which added delays to the catheter removal process. However, professional confidence and capability were reported to be improved over time.

"We usually get advised by the medical team on the ward round when they want the catheter removing. We don't make that decision" (nurse, HCP16).

"The capability to decide generally comes down to the experience of the nursing staff, because the less experienced staff quite often wait for the doctors to say, "Right, the catheter can come out," whereas sometimes if there are no complications, we (experienced staff) *just go ahead and do it. Because we know that's what the doctors would do"* (nursing ward manager, HCP02).

"I was very shy when I first qualified and didn't feel confident in approaching the consultant directly. But now I am okay as I have worked here for a long time" (nurse, HCP11).

"I would be comfortable being able to ask the junior doctor. But it would bother me if I had to ring up and ask the surgeon" (junior nurse, HCP07).

"It definitely discouraged me to speak with the consultants when I was the new kid on the block. Asking them about catheter removal was out of the question. If I had to I would do it. But I'd be shaking but would do it for the patient. If I could help, I preferred to mention it to a senior nurse or a junior doctor first" (nurse, HCP11).

Beliefs about consequences

Barriers coded to this domain explored HCPs' beliefs about the consequences of prolonged catheter duration. Participants believed that the patient's inability to manage without a catheter was an important consequent in determining catheter duration. They also described

that consequences of keeping the catheter in for longer could have an adverse effect on patients as well as the healthcare system.

Sub-theme 1: Patients' ability to manage without a catheter

The participants reported that a decision to remove the catheter is based on factors that are individual to each patient and their ability to manage without a catheter. These factors were described as: a patient's age (younger versus older patients), level of physical dependence, mobility, post-operative pain, skin integrity, and catheter indication (surgery, urinary retention, fluid monitoring). Patients' physical dependence and reduced mobility were described to have a potential effect on nursing staff members' motivation to promptly remove a catheter; in certain situations it was expressed to be an object of convenience, especially during low levels of nursing staff on the ward.

"The catheter duration can vary. There's never a definitive guideline, it tends to be based on the individual patient and their mobility" (healthcare assistant, HCP13).

"When they are up and able to walk to the bathroom. I would say that's pretty much an indication that the catheter can be taken out then" (nurse, HCP06).

"I do think some elderly patients being so debilitated and physically dependent, that often it's difficult to get the catheter out quicker. Looking at the overall picture, it can be quite distressing if you've got a lot of urine frequency and you haven't got a urinary catheter. Particularly if you can't walk" (nurse, HCP08).

"Actually, patient's poor mobility and dependence can be a contributing factor, because once a patient's got a catheter in, it's convenient, you don't need to worry about them passing urine when they might require an assistant to go to the toilet. That might actually be another reason for nursing staff not to be motivated to expedite the catheter removal, whereas in other cases, where patients are mobile, they might well be as there will be less dependence on staff as a result. I have encountered such situations" (doctor, HCP14).

"I feel like I'm saying a bad thing. Keeping a catheter in sometimes is more convenient workload-wise, and it does happen in practice when you are short staffed. But it's not convenient for the patient" (nurse, HCP15).

Sub-theme 2- Consequences of prolonged catheter duration

Consequences of prolonged catheter duration were reported to affect patients and the healthcare system. For patients, these were reported to be trauma, dependence on the catheter from loss of bladder control (incontinence), muscle atrophy (lazy bladder), becoming an object of convenience for patients and staff, the psychological impact of incontinence, and frequency of urination causing distress.

"Infection, damage to the urethra. I think sometimes psychologically the patients can have problems with them being in and out which causes distress. They become very uptight, obviously, if we've got to re-insert a catheter to a chap, it can be very painful as well. I think infection and sepsis is the main thing" (nurse, HCP08).

"The complications from leaving the catheter in for longer patients might get an infection and become reliant on it may be, getting lazy and patient not wanting to go to the toilet themselves which is also more convenient for staff, and maybe chronic problems with incontinence" (doctor, HCP12).

Consequences of prolonged catheter duration on the healthcare system were described to be a strain from the costs of antibiotics and the added length of hospitalisation affecting bed space.

"Consequences of catheter infections would mean extra days in hospital, so extra investigations like blood tests for microbiology, ultrasounds of renal tract, antibiotic treatment and all the rest of it; recurrent infections, more staff time, because it's a burden on the doctors seeing them and the nurses monitoring them, and everything else, that goes with it…From constantly reviewing it and taking it out promptly, its best for the patient; if it's best for the team. Is it best for the hospital? It definitely is, because it will reduce the time and money involved, and even the bed space" (doctor, HCP14).

Motivation and goals

For many participants, their low level of motivation for removing the catheter promptly was seen to be influenced by self-related factors as well as factors related to the patient's motivation to have their catheter removed.

Sub-theme 1: Self-related factors

The participants believed self-related factors which affected their motivation to prompt catheter removal were: work overload, competing demands pushing catheter removal to the bottom of task priority list, and the convenience of leaving a catheter in-situ during low staffing periods.

"When you have too much to do, taking bloods and other things like managing another patient's pain really can interfere with your intention to remove the catheter out promptly" (doctor, HCP12).

"Sometimes, it's a case of leaving it in because it's more convenient, it gives staff less jobs to do when you are thin on the ground…" (nurse, HCP07).

"I would say if we were short staffed, it's easier to leave the catheter in, and you don't have to take patients to the toilet which sometimes needs two people" (nurse, HCP15)

Sub-theme 2: Patient-related factors

The participants recognised that patient factors also contributed to lowering their motivation level to promptly remove the catheter. For example, a patient's lack of concern about the removal of their catheter, their inability to manage without a catheter, and their wish to continue to have the catheter in-situ due to either convenience or physical dependence for toileting.

"If the patient wasn't too bothered about it being there, I'd probably think it's okay to leave it for now, it's not a priority. But if they wanted it out because getting pain from it, I'd try my best to remove it straight away, to make them more comfortable" (nurse, HCP07).

"Sometimes patients are adamant that they want it left in because they can't walk to the toilet. It's their choice at the end of the day" (nursing ward manager, HCP02).

Memory, attention and decision processes

Barriers coded in this domain mainly related to HCPs' memory and decision processes.

Sub-theme 1: Forgetfulness

The participants reported a prompt approach to catheter insertion, but forgetfulness at different stages of catheter care related to removal. For example, forgetting to document the expected catheter removal date in the catheter care plan, a lack of written catheter removal instructions from the surgeon in post-operative notes and/or by other members of the medical team, and forgetting to explain the catheter removal process to patients.

"I think everybody remembers to put a catheter in because there's a clear indication, but when it comes to removal – sometimes we forget to take it out" (nurse, HCP14).

"I do try to document the expected removal date and time but sometimes I realise that I've forgotten to write it down" (nurse, HCP16).

"If the surgeon forgets to document in the notes, it delays the catheter removal" (HCA05).

"It does happen at times when medical staff forget to write the removal date in the notes, then it takes longer to get it out" (nursing ward manager, HCP02).

Computer-based reminders, whether related to catheter removal or not, were perceived as a barrier by the HCPs during busy times. HCPs described disregarding the electronic reminders,

especially when they were trying to access a patient's electronic record to continue with tasks at hand (indifference to/overload of electronic pop-up reminders).

"I don't think flashing reminders on our computers would help to get the catheter removed quicker. There are a lot of things and reminders that come up. To carry on with what you are trying to do, we would just click it off" (doctor, HCP14).

Sub-theme 2: Attention

Missed opportunities to discuss and assess catheter removal on a daily basis, in addition to the catheter being overlooked were reported to cause delays in catheter removal.

"I would imagine the catheter gets delayed by a couple of days because of being overlooked and not being assessed on a daily basis" (doctor, HCP12).

Sub-theme 3: Decision processes

In terms of decision processes, HCPs prioritised other competing demands over catheter removal, especially during low staffing periods on the ward. Catheter removal was described as a task low on the priority list. This sub-theme had a cross over with the *Social influences* (competing demands) and *Environmental context and resources* (resources) themes.

"I would obviously decide and prioritise the care. If I had a really sick patient, I'd have to attend to them first. The catheter may not come out straight away because of other jobs but we aim to get it out that day or night." (healthcare assistant, HCP05).

"If I couldn't remove it promptly from receiving doctor's order then it's because you are thin on the ground with work overload" (nurse, HCP10).

"If it's going to delay patient's discharge, then I'll think about it as it's a compulsory need to get it out over other tasks, but otherwise it doesn't always factor into my day-to-day decision-making for patients" (doctor, HCP14).

Environmental context and resources

This theme extracted HCPs' beliefs about how environmental factors, e.g. ward layout, location and availability of the toilets, patient accessibility, and resources, affect the timing of catheter removal.

Sub-theme 1: Ward layout, location and availability of the toilets

HCPs explained that the ward layout, in terms of the location and number of readily available toilets to patients, can affect the timing of catheter removal. In the post-operative period, even a short walk to the toilet can be of inconvenience to the patient. This, in addition to a lack of readily available toilets, can lead to patients' anxiety about having accidents, the loss for dignity, and subsequent reluctance to have their catheter removed.

"If the patient's in a bed right next to the toilet or have an en-suite, it wouldn't affect taking a catheter out because they're not too far away to get to the toilet, and they can just walk through. But if the patient's in the bay and they're quite far away from the toilet, in pain after surgery and not too steady on their feet, that would definitely add time to their catheter removal" (nurse, HCP07).

"Patient can be quite anxious about getting the catheter out if they have a frequency of urine and toilet not being close or available in time. They worry about having an accident and wetting themselves which can be mortifying. Obviously, the one toilet for six patients in a bay can be very busy" (nurse, HCP08).

Sub-theme 2: Access to patient

The nursing participants described that sometimes, despite having ample staff and the presence of a catheter removal order, it can be physically difficult to gain access to the patient to remove the catheter. Depending upon the location of catheter removal, such as at the bedside, the nearest toilet, or in the treatment room, barriers to gain access to the patient were described as visiting times, the patient physically being away from the ward for investigations, and protected meal times.

"Sometimes you physically can't get access to the patient to remove it. If a patient's got visitors, I wouldn't be able to take the catheter out because the family is sitting all around the patient and can be an obstacle. Or other times would be, if they went off for an X-ray, for scan, for any investigations, that would stop me from taking the catheter out delaying the catheter removal" (nurse, HCP10).

"Things like ward rounds, visiting times, medication rounds and protected meal times stops you from removing the catheter" (nurse, HCP06).

"Sometimes it can be difficult if the doctors say remove it now, they've just done a ward round and the meals arrive, I can't really remove it then because the meal times are protected, so I'll wait until after the lunch. Anyhow, it doesn't make much difference, but then if you get called away to something else, it all adds up" (nurse, HCP11).

Sub-theme 3: Staff resources- shortage

All participants' reported that there was no shortage of material resources in their clinical areas to do the catheter removal. However, during times when there is a shortage of staff resources, increased individual HCP workload added delays to catheter removal. The participants reflected the influential perception of risk, competing tasks with consequences for themselves if not completed by the end of their shift.

"People resources make a big difference. The nursing staff and healthcare assistants are always super busy. If they're short staffed on top, it doesn't facilitate a) taking them out swiftly, or b) being able to then cope with patients once they've had the catheters out if they need someone to walk with them to the toilet; or the commode to pass urine into. In situations like that leaving the catheter in becomes an easier option" (doctor, HCP12).

"We try to get the balance right when there's a lot to do. If we're a short-staffed that can often have a knock-on effect on getting the catheters out quickly because there's always other things that need to be prioritised first before I can go home" (nurse, HCP08).

Social Influences

The *Social influences* domain generated three sub-themes that were reported to affect delayed catheter removal. These were ward culture/group norms, staff attitudes concerning senior medical staff members' availability and approachability, the hierarchical structure linked to the catheter removal decision process, and the patient/family's involvement in the catheter removal process.

Sub-theme 1: Ward culture/group norms

The participants explained that the different cultures of patient management routines between medical and surgical wards can affect how frequently catheter are assessed for removal.

"Unlike surgical wards, medical ward rounds don't happen every day here. MDT rounds are once a week. We have three consultants on the ward and there are three MDTs, they each have one round a week. Their patients will be discussed at the MDT for catheter removal or we have to ring around to ask for the permission..." (nurse, HCP11).

"There's a cultural problem with specific wards; it's difficult to prescribe any change including prompt catheter removal to staff who are set in their ways" (nurse, HCP15).

Sub-theme 2: Staff attitudes

The nursing participants and junior doctors believed the approachability (attitudes) and the availability of medical staff to obtain a catheter removal order can affect the length of catheterisation.

"I wouldn't ring the consultant up, about the catheter and disturb them. I suppose it is a bit of a barrier that they're not there on the ward to consult freely and you have to wait until the ward round which happens only twice a week" (doctor, HCP12).

"…and you can't always get hold of the medical staff which doesn't help to get it out quickly" (nurse, HCP11).

Sub-theme 3: Hierarchical structure linked to catheter removal decision process

The catheter removal order primarily comes from the medical team which gets passed down to the nurses and healthcare assistants to perform the catheter removal procedure.

"Most of the time, the order would have to come from the senior medics, and what they want, because sometimes, they might not be too happy if you've gone ahead and removed the catheter. It's a very top-down approach" (nurse, HCP15).

Sub-theme 4: Patients' and families' involvement in the catheter removal process

The participants explained that occasionally patients inquire about their catheter removal. However, this was reported to be an infrequent practice, with a likelihood that some staff may feel challenged by being prompted by the patients. The participant's also highlighted that the family members of patients with high levels of dependence can be reluctant to have the catheter removed.

"Occasionally, when a patient asks about their catheter removal, some staff may think the patient is trying to tell you to do your job and not like being prompted, but in a way, they're not. They're just reminding us that it needs to come out" (nursing ward manager, HCP02).

"I've come across before where they've said, "The family want it kept in," and it's been kept in for the family" (healthcare assistant, HCP13).

"I've found that patient's families and relatives can sometimes be a barrier, because they've wanted it kept in, because when they have to look after a dependent patient who needs assistance for toileting, it's going to be easier for the family to manage with a catheter" (healthcare assistant, HCP13).

Emotion

The barriers related to HCPs' emotions due to delay in catheter removal generated two types of feelings i.e. negative and indifferent.

Sub-theme 1: Negative feelings

A majority of the participants expressed that delay in catheter removal due to their forgetfulness generated anxiety, concern, disappointment, blaming themselves, guilt, and feeling bad for the patient.

"I probably would start to feel a bit anxious and concerned that I haven't taken the catheter out when I was supposed to" (nurse, HCP15).

"I would feel disappointed if I couldn't get the catheter out quick enough" (senior nurse, HCP08).

"Especially if there were detrimental effects to the patients with delayed catheter removal, then you would probably blame yourself" (healthcare assistant, HCP05).

"I'd feel guilty, I'd made a mistake and forgot to assess patient's catheter removal" (doctor, HCP12).

Sub-theme 2: Indifferent feelings

Two HCPs reported that if the catheter removal got delayed or was removed promptly, it did not affect the way they feel.

"It's easy to overlook, so I wouldn't feel much if it wasn't taken out on time" (doctor, HCP14).

"I don't think catheter coming out early or late would make us feel anything really. It's just one of those things if it's not necessary, there's no need for it to be there" (nurse, HCP07).

Research objective 2: enablers to prompt catheter removal practice

Four of the twelve domains identified enablers to the timing of catheter removal. These were: *Skills, Behaviour regulation, Social influences* and *Emotion*. A conceptual map of enablers within the domains and associated sub-themes has been illustrated in Figure 4.2.

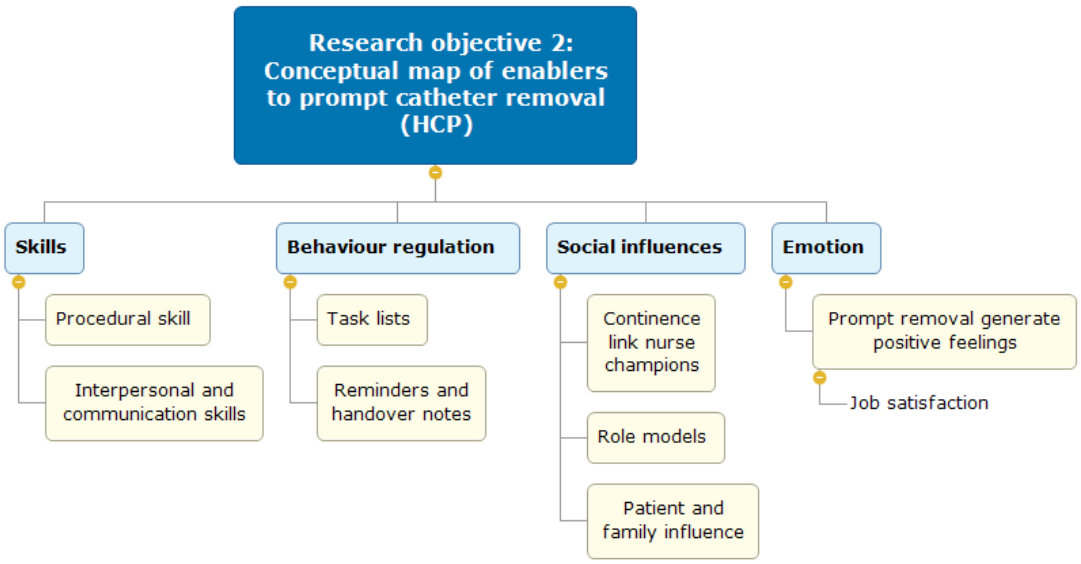


Figure 4.2: Conceptual map of healthcare professional enablers to prompt catheter removal practice

Skills

Sub-theme 1: Procedural skill

In the presence of a removal order, HCPs from all professional backgrounds reported being highly competent at performing a catheter removal.

"Very confident to remove the catheters if I know it's ready to come out" (healthcare assistant, HCP05).

"I'm skilled in removing catheters. It's a simple procedure. I developed this skill through experience and being observed" (nurse, HCP10).

The catheter removal was perceived as a low risk, straightforward, and quick procedure.

"If I've got all my equipment, it would take me less than a minute. Deflate the balloon, pull it out, it's done. It's that quick" (doctor, HCP14).

Sub-theme 2: Good interpersonal and communication skills

Many participants recognised effective interpersonal and communication skills between peers and with the patients as enablers to facilitate prompt catheter removal. These skills were felt to be particularly important to HCPs given the intimate nature of the catheter removal procedure and having a good rapport to increase patients' compliance.

"In terms of interpersonal relationships, patients need to know when the catheter needs to be taken out, and obviously patient needs to give permission to do what is an intimate procedure; putting it in or taking it out" (doctor, HCP14).

"Interpersonal skills definitely play a part especially during the handover, so everybody knows whose catheter needs to be removed and when" (nurse, HCP10).

Nursing participants reported that good communication skills within the team members were also deemed essential for prompt catheter removal at the time of shift hand over and to approach medical staff to obtain the catheter removal order.

"Good communication amongst the team members helps to get it out quickly" (nurse, HCP07).

Behaviour regulation

The enablers reported in this domain to regulate prompt catheter removal behaviour generated two sub-themes. These were task lists and receiving reminders from colleagues and sometimes patients.

Sub-theme 1: Task lists and handover notes

The participants reported that having individual lists to remind themselves and team members helped them not only to regulate their catheter removal behaviour but also with other routine tasks that they had to complete during their shift. The lists were updated during the handover at the start of each shift.

"I write lists to remind me. I have got lots of lists of what to do as I go through the day, and I take off jobs as I get through them" (nurse, HCP09).

*"Normally, we always have handover notes on a sheet which we update at the start of each shift, so we know what's needing done" (*enrolled nurse, HCP03).

Sub-theme 2: Reminders and handover notes

Participants reported that reminders from colleagues, and sometimes also from patients, facilitated catheter removal.

"If I have forgotten, at some stage your colleague will say, "Have you taken the catheter out?" that's how it works. Whether it's via delegation or remembering to do it yourself from the handover sheet" (enrolled nurse, HCP03).

"*If I've forgotten myself, sometimes a patient might remind me, it's a prompt for myself to remember to go and do this for them"* (nurse, HCP16).

Social Influences

Three sub-themes were generated for the enablers related to the *Social influences* domain. The participants reported that professional support and positive influence from continence link nurse champions, senior medical and nursing staff as role models, and the patient/family's involvement helped with prompt catheter removal.

Sub-theme 1: Having a dedicated champion - a continence link nurse

The participants reported that on each ward there is one member of the nursing or ancillary staff designated to be the 'continence link member' with a remit to champion best catheter practice. The link member's role is perceived as a positive influence by HCPs to improve catheter removal practices and implement related guidelines. It was also suggested that there is room to maximise the potential of this role, whereby in the absence of medical staff, the link nurse could be the decision-maker and advocate daily removal assessments for prompt catheter removal, which is not yet the case.

"You've got catheter care link nurses on every ward, so to roll the guidelines out, link nurses would be ideal to get the process started" (specialist nurse, HCP01).

"I would say, on the ward, it will be very useful to have somebody with a specialist role like continence link nurses, who can review every single catheter on the ward on daily basis to advocate prompt removal. Especially when ward rounds happen on a very ad-hoc basis on medical wards to discuss catheter removal routinely" (doctor, HCP14).

One of the study participants, also a continence link member, described that, at present, this role is taken on a voluntary basis. They perceived that championing best catheter practice was not always possible due to a lack of dedicated time for this role and that they had to perform this role on top of their normal duties.

"I took this role voluntarily like five years ago, and with anything I do, I always try and meet high standards, good practice, and then develop ways to make it easy for staff and improve systems and that. This is why I developed the audit. But you can only do so much when you don't always get dedicated time for doing it properly. On top you have to get on with all your normal jobs", (healthcare assistant; continence link member, HCP13).

Sub-theme 2: Having role models

The participants reported that having senior members of the nursing and medical staff on a ward, who questioned the presence of urinary and other invasive catheters (drains, intravenous cannulas), is an effective way of facilitating the conduct of daily assessments and

prompt catheter removal. The participant spoke from their previous experience from working on a particular ward, but it was reported to be an uncommon scenario.

"The senior staff like consultants and ward sisters play a big part. One of the wards I worked on was cardiology at the xxx hospital. There was very much of culture there, of having as little as possible inside the patient. If someone had a catheter, it got reviewed daily, because the consultant wouldn't have it any other way. As soon as it goes in, it's questioned, "Why is it in? Does it need to stay in? When can it come out?" That really prompted us, throughout my time on that ward, to make sure that people only had those things in when they were necessary" (healthcare assistant, HCP13).

"Facilitators would be- senior staff fostering a culture to get all the lines out ASAP just like the cardiology ward I mentioned. It's not common on other wards. If they foster a culture where these kinds of things are kept to a minimum where possible, I think it would help to get the catheters removed quicker and promote good practice" (doctor, HCP14).

Sub-theme 3: Patient and family influence

Some participants reported patients' and families' involvement in the catheter removal process as an enabler.

"Patients do ask sometimes if their catheter can come out but not all of them ask. When they do, you think about it and that's a good thing. So that could be another thing; educating patients to get involved, also" (doctor, HCP14).

"Sometimes the family will ask "when's this catheter coming out?" Especially when we're talking about discharge. So there's a link down there, relatives for patient helps us in getting it out" (nurse, HCP10).

Emotion

The participants reported that timely catheter removal generates positive feelings in terms of job satisfaction.

Sub-theme 1: Job satisfaction

"Taking the catheter out promptly would make me feel good. You feel as if you're carrying out an efficient service carried out with high standards of care and reducing potential complications that could occur" (nursing ward manager, HCP02).

"*Yes, I do take the initiative to get the catheters out quickly because I love the role that I'm in and be patient's advocate*" (healthcare assistant, HCP13).

4.5 Discussion

4.5.1 Summary of main findings

To my current knowledge, this is the first study to use the TDF to provide new insights to HCPs' behaviours concerning catheter removal practice. The study aimed to explore current local catheter removal practices and identify barriers and enablers to HCPs' behaviours concerning catheter removal. The results show that there is no provision of baseline guidance on the timing of catheter removal. Local, national and international guidance on catheter removal lacks specificity on the timing of catheter removal. This could be one of the governing factors behind reported variations in catheter removal practices. Encompassed within 12 domains of the TDF, the barriers to prompt catheter removal were identified within ten domains: *Knowledge; Social/professional role and identity; Nature of the behaviour; Beliefs about capabilities; Beliefs about consequences; Motivation and goals; Memory, attention and decision processes; Environmental context and resources; Social influences;* and *Emotion*. Enablers to this clinical behaviour were best represented in four domains: *Skills, Behaviour regulation, Social influences,* and *Emotion.* Two domains, *Social influences* and *Emotion*, identified barriers as well as enablers.

4.5.2 Strengths and limitations

The study has a number of strengths. This was a novel study to understand HCPs' behaviour-related barriers and enablers linked to delays in catheter removal, which is one of the main reasons for catheter-related infections. The results identified in this study fill a gap in the literature and point to clear opportunities for a theory-based intervention.

The criteria-based sampling approach ensured a diversity of HCPs' perspectives were captured. These varied perspectives contribute important insights to the current understanding about catheter removal practice and what influences best practice. Methodologically, this study illustrates a systematic and replicable, theory-linked approach to collate evidence, as recommended by the UK Medical Research Council to design and evaluate complex interventions. The TDF was applied to design and analyse the interviews, providing broad theoretical coverage and a conceptual basis for assessing implementation problems which are capable of drawing out beliefs that can signify potential mediators to behaviour change (Francis *et al.*, 2012). This was a useful methodological approach for exploring HCPs' behavioural determinants which can link to theory/theories for developing theory-based interventions (Rothman, 2004). For example, the TDF domain *Beliefs about capabilities* maps onto the 'self-efficacy' construct in the Social Cognitive Theory for cognitive development and functioning (Bandura, 1993). The barrier identified within this domain, such as nurses' and junior doctors' inability to make the catheter removal decision, can be addressed using specific behaviour change techniques to enable them to perform this behaviour (Wood *et al.*, 2015). Moving forward, the systematic approach can continue with further steps, where identified modifiable barriers can be targeted in a behaviour change intervention via the use of specific behaviour change techniques (French *et al.*, 2012) in addition to addressing the gap in local, national and European guidelines to optimise catheter removal practice.

To avoid a superficial application of the domains (Francis *et al.*, 2012) the study had consensus input from two experienced health psychologists, one at the study design and development of the interview schedule stage and the second as an independent second coder. In addition, multidisciplinary consensus discussions critiqued the data collection tool and emerging analysis.

However, like any research, this study also had some potential limitations. The possibility of selection bias has been recognised (Collier and Mahoney, 1996). The ways to overcome selection bias were considered by clear identification of study population, and seeking a diversity of views to capture the breadth of perspectives from nursing, medical and ancillary staff members' involved in the catheter removal process.

In common with most qualitative research studies, the results presented here were derived from a relatively small number of participants. However, the background, setting, and level of participants' professional experience were varied to obtain wider views. The results may be considered limited due to the study being conducted in a single organisation, as different hospitals have different resources, cultures and pressures on staff and their workload. However, due to the large size of the secondary care NHS organisation, HCPs from multiple wards, diverse professional backgrounds and different specialities were included. The findings correspond to secondary care nursing, medical and support staff HCPs, however the results might bear some common barriers with HCPs in the community setting who care for patients with short-term urinary catheters i.e. nursing homes and community rehabilitation services. Although, despite this, the findings should be carefully considered allowing for: differences in catheter insertion indications between the community and secondary care patients, resource allocation, and the difference in professional roles and identity. For example, nursing home settings are mostly nurse-led with empowered work teams (Yeatts and Cready, 2007) where nurses can make catheter removal decisions as well as doing the removal procedure; as identified in the qualitative study reported in this chapter, this is not always the case in a secondary care setting. Nevertheless, the methodological approach taken in the present study could be used in future research in other settings.

4.5.3 Findings in relation to previous research

This study recognised the importance of appraising local, national and international guidance and identifying HCPs' behaviour-related barriers and enablers to the timing of catheter removal (see Figures 4.1 and 4.2).

Appraisal of guidance documents and current catheter removal practices

The appraisal of the current UK guidance highlights that there is no specific information on the timing of catheter removal provided to HCPs (National Institute for Health and Care Excellence, 2014; Loveday *et al.*, 2014), which is likely to be the reason for variations in the local catheter removal practices highlighted in this research. In contrast to the UK guidance, American CDC guidance suggests catheter removal within 24 hours unless there is a documented indication for continued catheterisation (Gould *et al.*, 2010). Furthermore, it was identified that there was local guidance on 'how to insert and maintain a catheter' but no guidance available on 'when to remove a catheter'. Consequently, removing the catheter within 24 hours of insertion or conducting daily assessments for its removal is deficient in routine clinical practice locally.

Although there are no specific indications in the UK guidance on the timing of removal, the guidance suggests that HCPs are required to conduct daily catheter removal assessments and document the indication for a catheter's continued use until its removal. Current practice appears to be out of step with the recommended guidance, whereby considerable variation in the timing of catheter removal practices was identified as relating to catheters being removed at either midnight or in the early morning. This practice and related variations are neither evidence-based (Tenke *et al.*, 2011; Gross *et al.*, 2007) nor supported by the guidance (Loveday *et al.*, 2014; National Institute for Health and Care Excellence, 2014; Gould *et al.*, 2010). Guidance suggests that catheters should be reviewed regularly and removed as soon as possible (National Institute for Health and Care Excellence, 2014). Waiting to remove the catheter until midnight or 6am the next morning further prolongs the length of catheterisation (Wyman, 1987). In general, HCPs are eager to insert a catheter rather than considering alternative methods for bladder drainage. However, a comparable eagerness is not observed in their behaviour towards catheter removal (Lo *et al.*, 2008). Despite the national and global initiatives, HCPs' behaviour regarding promptly removing catheters remains inadequate and is not in line with preventive strategies to improve CAUTI rates (Meddings *et al.*, 2014).

Study participants described the effects of a relatively new local practice in Urology, TWOC, in which patients are discharged home after surgery with a catheter in-situ; patients are required to return to the hospital for a TWOC appointment (at a clinic on a day ward) during which the

catheter is removed. This approach has both positive and negative impacts. The benefits of this approach were envisaged to be a reduction in hospital duration, a reduction in associated complications from prolonged hospitalisation, and freeing-up bed space to take on new patients to reduce waiting lists. However, removing the catheter after a patient has been discharged home was reported to increase the duration of catheterisation (in some cases by an additional two weeks) due to a lack of appointments caused by an excessive case-load in nurse-led TWOC clinics (Mariappan *et al.*, 2007). These delays put patients at an increased risk of developing CAUTIs (Gokula *et al.*, 2004). Prolonged catheter duration, as a consequence of this practice, can lead to a rise in catheter infections and related complications including the transient atrophy of bladder muscles (lazy bladder) (Gould *et al.*, 2010).

Over time, the relative advantage of shortening hospital duration versus prolonging catheter duration may not achieve the desired effect that was originally envisaged by the clinicians. The evidence from a systematic review and meta-analysis (Yu *et al.*, 2018) suggests that early catheter removal can be done safely in patients who have undergone transurethral resection of the prostate (TURP) without significantly increasing morbidity, such as haemorrhage (RR 1.07, 95% CI 0.54 to 2.13) and risk of re-catheterisation (RR 1.12, 95% CI 0.73 to 1.72), while shortening the hospital stay. On the other hand, this review reported delayed removal to be associated with increased CAUTIs (RR 0.46, 95% CI 0.24 to 0.91) and longer hospital stays (SMD -1.33, 95% CI -2.22 to -0.44) (Yu *et al.*, 2018). Although this review reflects the isolated clinical scenario of TURP procedures, it still necessitates further assessment and evaluation of this practice. To avoid delays in scheduling TWOC clinic appointments, home removal of urethral catheters is an avenue that could be explored in future. The feasibility of urethral catheter removal at home by parents of paediatric patients has been tested as an alternative to catheter removal by an HCP (Braungart and Goyal, 2019). This study reported minimising the anxiety and inconvenience instigated by delays in getting a clinic appointment for catheter removal. The same scenario could be extrapolated to cover the 'home with a catheter' population.

Barriers to prompt catheter removal

There was a considerable difference in the levels of knowledge among doctors and nurses regarding catheter duration, particularly on the microbiological aspect of CAUTI development.

This may have played a significant part in prolonging catheter duration (Loveday *et al.*, 2014). Nurses may be less informed because the microbiological aspect of catheter infections is neither covered in the pre-registration nursing programme curriculum (Francis and O'Brien, 2019) nor at the local hospitals in-house training programme for nurses. If HCPs are unaware of the mechanisms of CAUTI development, which are related to longer catheter duration, they are less likely to remove catheters promptly or perceive the delay as causing harm to patients by leaving the catheter in-situ unnecessarily (for a few extra hours, the entire shift, or in excess of 24 hours). This knowledge gap affects HCPs' beliefs about consequences, which in turn affects their intention, asserting an intention to knowledge gap (Orbell *et al.*, 1997) and ultimately affects the target behaviour.

In addition to the absence of local guidance on catheter removal, HCPs' (especially nurses) were uncertain of the national guidance. This also suggests that nurses are more likely to be aware of the local policies and guidelines rather than national guidelines. Although participants were uncertain about the content of national guidance, at present (2019), as discussed earlier, the UK guidance on short-term urinary catheters lacks specific advice on the timing of catheter removal (Loveday *et al.*, 2014; National Institute for Health and Care Excellence, 2014). In comparison, Jain *et al.'s* study also reported that doctors' knowledge was significantly better than nurses' (2015) which validates the findings reported in this chapter. The differences in HCPs' knowledge is most likely due to variations in the training content provided to doctors and nurses, and a lack of clarity in guidelines, highlighting the need for streamlined guidance on the timing of catheter removal. Providing HCPs with more knowledge on these factors is necessary but not sufficient on its own to be translated into practice (Kristensen *et al.*, 2016).

Overuse of catheters and prolonged catheter duration have been associated not only with convenience for nursing staff (Apisarnthanarak *et al.*, 2007; Saint *et al.*, 2002; Jain *et al.*, 1995) but also with patients' preferences (Bhardwaj *et al.*, 2012; Safdar *et al.*, 2016). Some nursing participants reported favouring the ongoing use of a urinary catheter for patients with poor or reduced mobility who need a staff member's assistance for toileting. This finding was confirmed by the doctors who participated in the study. Some nurses reasoned that their rationale to leave the catheter in for longer was for the patient's safety rather than convenience for staff, citing the prevention of falls in patients with poor mobility when there

are insufficient staff members to assist with toileting. However, enhancing patient safety by prolonging catheter duration remains to be debated against patients suffering from CAUTIs and their management. Continuation of the catheter to prevent falls has been highlighted as a 'well-intended' misconception by Lo and colleagues (2014). Falls can be prevented by implementing strategies such as instructing patients to request assistance, providing patients with non-slip footwear, and keeping the path to the toilet free of obstacles (Lo *et al.*, 2014). A catheter can hinder early ambulation by confining patients to bed (Calotta *et al.*, 2018) with a possible loss of autonomy if an elderly patient is willing to use the toilet but refrained by staff for fear of falling. Patients' views should be taken into consideration when considering options to manage their incontinence (Dingwall and McLafferty, 2006).

Barriers linked to the *Social/professional role and identity*, *Beliefs about capabilities,* and *Social influences*

The distinction between medical, nursing, and ancillary professional roles provided useful insight into professional capabilities and social influences around the catheter removal process. This study highlights that the decision to remove a catheter is primarily made by the medical staff (in some cases by senior nursing staff), while the actual catheter removal procedure is performed by the nursing and/or ancillary staff. The results presented here support findings from previous research on the hierarchical structure of the catheter removal decision-making process as a barrier to prompt catheter removal (Ballard *et al.*, 2018). The hierarchical structure has a top-down approach and nurses' inability, and perhaps unwillingness, to make catheter removal decisions adds delays to catheter removal. This is in a context where nurses have to obtain a catheter removal order from medical staff who are not readily available on the ward. Therefore, a patient who may be able to manage without a catheter will experience further delay to its removal.

Simplifying the process to optimise decision-making by empowering nursing staff to make catheter removal decisions independently could facilitate more timely catheter removal (Adams *et al.*, 2012). Through support and education (Wood, 2018), nursing empowerment, achieved via the leadership and development of nurse-driven protocols, is an area with significant potential yet requires further development (Richardson and Storr, 2010). Improving the perceived autonomy of junior nursing and medical staff, their professional confidence and ability to approach senior colleagues to obtain a catheter removal order, is an

option that can be enhanced in an intervention (Bedwell *et al.*, 2015). Nurses can play an influential role as the advocates for care quality and patient safety initiatives, including the reduction of CAUTIs (Parry *et al.*, 2013), taking into account that they spend more time with patients than doctors and are up to date with how rapidly the patient is making progress from the recovery perspective.

A lack of peer-support, staff attitudes, and the nurse/physician relationship (cultural norms) in relation to standard catheterisation practice have been highlighted as the potential contributory factors to patient safety (Laschinger and Leiter, 2006). The current findings are in support of this research, whereby approachability of senior medical staff influenced the ability of junior HCPs to obtain a catheter removal order (lack of social support). Junior nurses and doctors indicated a reluctance to approach senior medical colleagues regarding a patient's catheter removal, especially when the physician/surgeon was away from the ward. Discussing or obtaining a catheter removal order over the telephone was perceived by HCPs as a disturbance to their work for a benign (non-urgent) problem. However, evidence suggests that delaying catheter removal when it is no longer required is one of the reasons for developing CAUTIs (Gokula *et al.*, 2004). These findings also link with inter-professional miscommunications and related poor patient outcomes (Foronda *et al.*, 2016).

However, as described in the enablers section below, poor communication and a lack of support from senior colleagues (social support) was not always the case. On certain wards, senior medical and nursing staff were seen as role models who influenced nurses' and doctors' practices (Croxon and Maginnis, 2009; Laschinger and Leiter, 2006; Wright *et al.*, 1997) and encouraged their teams to practice prompt catheter removal. This also includes nurses in infection and prevention control and continence link nurse roles who champion prompt catheter removal and reducing CAUTIs (Sopirala *et al.*, 2014; Thompson and Smith, 2002). These dedicated roles have the potential to increase awareness amongst colleagues regarding infection control and continence issues within their respective clinical areas and motivate staff to improve practice (Dawson, 2003). However, it has been highlighted that the full potential of these roles is not always achieved due to barriers such as conflicting clinical priorities, a lack of a well-defined role description, varying staff approaches to managing urinary continence, and insufficient time for training (Dingwall and McLafferty, 2006).

Barriers linked to *Motivation and goals*, *Memory, attention and decision processes*, and *Environmental factors and resources*

There was considerable overlap across these three domains. Whilst previous research has highlighted the impact of high job demands on HCP motivation (Nico and Mariët, 2003), the effect of low staffing levels has a more substantial impact on resources in terms of poor patient outcomes and subsequent costs of treatment (Griffiths *et al.*, 2018; Cho *et al.*, 2003; Thungjaroenkul *et al.*, 2007). The study reported in this chapter builds on these findings by suggesting that staffing levels may impact motivation levels, as well as memory, attention and decision processes, to promptly remove catheters.

Nursing participants reported that catheters were more likely to be removed quickly if the catheter removal order was already in place, compared to nurses having to initiate the catheter removal process when medical staff were not around. An explanation for this might be time constraints in making contact with the medical team to seek a removal order. Resources, in terms of low staffing levels, increased individual HCPs' workloads. This affected their motivation and goals to promptly remove the catheter by pushing catheter removal low down on the priority task list in order to meet competing demands. This links with the findings discussed earlier, that knowledge alone is not enough to translate evidence into practice (Orbell *et al.*, 1997) and competing demands/workload can interfere with HCPs motivation (Nico and Mariët, 2003). HCPs may have been knowledgeable about catheters and related infections, but workload issues would still prevent the prioritisation of catheter removal by necessitating task-switching to meet competing, pressing demands (Walter *et al.*, 2014). This is an important consideration to bear in mind when planning an intervention for HCPs.

Patient factors, such as unwillingness to have their catheter removed, a lack of concern and the convenience of staying in bed, also affected HCP motivation to promptly remove the catheter. These findings build on previous qualitative research looking at patients' perspectives on indwelling urinary catheter use in the hospital, which found that patients perceived indwelling urinary catheters as a device of convenience that helped them to pass urine without having to go to the toilet (Safdar *et al.*, 2016), especially in the post-operative period after surgery (Bhardwaj *et al.*, 2012).

To address HCP forgetfulness, much of the previous research indicates that criteria-based reminders and stop orders appear to reduce the rate of CAUTIs and has been recommended to be considered as a patient safety intervention (Meddings *et al.*, 2010; Meddings *et al.*, 2014; Wang *et al.*, 2017; Chen *et al.*, 2013; Ranji *et al.*, 2007). Inappropriate catheters are often forgotten about more than those with an appropriate indication (Saint *et al.*, 2000). Reminders to HCPs, either generated by computer or on paper (Arditi *et al.*, 2017) or from patients (Bhardwaj *et al.*, 2012), could help in bringing catheter removal to the forefront of HCPs' minds and remind them to remove the catheter when it is no longer required. As reported in a systematic review, studies have implemented reminder systems to tackle forgetfulness in an attempt to reduce catheter duration and prevent CAUTIs (Meddings *et al.*, 2010). A cluster RCT with a pre and post design measured the effects of reminder messages on excessive primary-care radiology referrals by including 244 general practices in the UK (Eccles *et al.*, 2001). The findings showed that a routine educational reminder message to radiographers is an effective way of reducing excessive referrals, without affecting the quality of referrals. In contrast to these studies, participants in the study reported in this chapter perceived general computer-based reminders to cause disruption when trying to access a patient's electronic medical record and were often disregarded to complete the task at hand. This finding is supported by a longitudinal qualitative study where general practice clinicians found the computerised decision support system clinically unhelpful and difficult to use (Rousseau *et al.*, 2003). In the context of current study, addressing forgetfulness alone would not be sufficient. Because there are several other issues identified related to professional roles/hierarchy, convenience, workload, and competing demands. Even if HCPs are reminded, there is the potential that catheters will still not be removed promptly due to these issues.

However, criteria-based and on-screen reminders have shown to be more effective in reducing CAUTIs than no intervention (Meddings *et al.*, 2014; Chen *et al.*, 2013). Literature suggests that reminders are more likely to be effective where a response is required before acting or disregarding, over reminders that do not require a response (Shojania *et al.*, 2010; Gordon *et al.*, 1998). Reminders accompanied with tailored interventions that target specific behaviours and those which were developed with the involvement of target clinicians are more likely to be effective than those developed without their participation (Forberg *et al.*, 2016; Gordon *et al.*, 1998). When considering reminder interventions to enhance the safety of catheterised patients, perhaps the reminder content should be developed with an explicit

rather than implicit approach, including an explanation justified by reference to an influential source deemed credible by clinicians.

The participants in this study perceived reminders from patients for catheter removal with mixed thoughts. Some participants perceived patient reminders to potentially have a negative effect, while others saw it as an opportunity to remove the catheter if they had forgotten to remove it in the first instance. Negative feelings amongst HCPs and patients have been reported to potentially cause tension and mistrust in the patient-provider relationship (Hrisos and Thomson, 2013). Future interventions targeted at HCPs should perhaps focus on promoting an open culture and encouraging patients to engage in the safety aspect of their care (acting as safety buffers), whilst the ultimate responsibility for patient safety remains with the HCP (Davis *et al.*, 2007). As per a Cochrane systematic review, the effectiveness of strategies to change organisational culture by changing healthcare performance remains inconclusive and recommends future research efforts should focus on effective methods to strengthen the evidence in this field (Parmelli *et al.*, 2011). This recommendation should be considered when designing an intervention to target organisational cultures.

Enablers to prompt catheter removal

Four domains identified enablers i.e. *Skills, Behaviour regulation, Social influences and Emotion*. The study participants from all professional background were highly skilled in catheter removal, and perceived it as a low-risk, quick procedure, as detailed in the Royal Marsden manual of clinical nursing procedures (Dougherty and Lister, 2015). The participants reported that there are additional skills necessary in the catheter removal process such as communication and interpersonal skills to initiate the catheter removal process, to obtain the removal order, or during performing the catheter removal procedure to increase the patient's compliance. This finding links with the existing literature, whereby good communication (Moore *et al.*, 2004) and interpersonal skills (Arnold and Boggs, 2015) have been identified as enablers to delivering patient care effectively.

The HCP participants in the present qualitative study explained that certain strategies enabled them to regulate their catheter removal practices. These were: individual task lists, handover notes, and reminders from colleagues and occasionally from patients. The handover practices have been previously evaluated and their importance has been highlighted to ensure

important patient information is not lost or misinterpreted during staff change-over (Talbot and Bleetman, 2007). The handover notes and task lists also help in retaining information and are an effective tool to cope with an increasing workload (Fisher *et al.*, 2017; Talbot and Bleetman, 2007). Reminders from colleagues and sometimes from patients, also helped the participants, which has been highlighted as an enabler for prompt catheter removal in much of the previous research (Meddings *et al.*, 2014; Meddings *et al.*, 2010; Chen *et al.*, 2013; Gordon *et al.*, 1998; Forberg *et al.*, 2016; Shojania *et al.*, 2010).

The study participants associated prompt catheter removal with positive emotions and job satisfaction. In line with this finding, the existing research presents positive emotions as a strong predictor of job satisfaction (Fisher, 2000). Support from senior members of the nursing and medical teams was perceived positively by the study participants and, in some cases, the senior team members were perceived as role models who championed prompt catheter removal. This is in line with current evidence whereby role modelling has been identified as a powerful strategy to improve professional performance (Cruess *et al.*, 2008). However, it is important to note that role models were not the norm according to the HCP participants; they did not generally exist in every ward to encourage timely catheter removal. This finding builds on existing research where role models have been described as an elusive concept (Speizer, 1981) and signify the need for more role models to promote best practices (Cruess *et al.*, 2008; Lockwood, 2006).

In addition to support from peers and seniors, participants also highlighted the importance of the continence link nurse role, a designated member of the nursing or ancillary staff on each ward who promotes best catheter care practice. Previous research has shown that the daily intentional rounds conducted by designated monitors have proven to reduce catheter duration and incidence of CAUTIs (Mabolo *et al.*, 2014; Saint *et al.*, 2014). However, the study participants believed that the role of continence link nurses in their organisation was underutilised and had greater potential to champion prompt catheter removal than was currently being demonstrated. The link nurses focused on auditing catheter documentation rather than being vigilant to unnecessary catheter insertions and monitoring catheter duration. This may be because the link nurses did not have a well-defined role description or dedicated time; this could be addressed as an element in an intervention strategy.

Some of the study participants were in favour of patients' and families' involvement in the catheter removal process. HCPs in favour of receiving prompts from patients and family members saw this as an opportunity to get past their forgetfulness (Turner *et al.*, 1994). Patients' involvement in the catheter removal process, therefore, needs further exploration. Reminders from patients may prove to be an effective intervention function to explore in the future intervention to overcome HCPs' forgetfulness (Saint *et al.*, 2005).

4.5.4 Implications

Practice and policy

The study findings identified barriers and enablers related to HCP's behaviours regarding short-term urinary catheter removal. Clinically, it shows that the current practice, even in a sample of participants who may be more positive about this practice, is not evidence-based. Given that the study participants often described the need for change in catheter removal practices, this research indicates that individual practices are likely to be modifiable. The barriers identified in this study present potential opportunities to develop an intervention that would address entire complexities attached to the catheter removal process, rather than addressing single barriers in isolation e.g. reminder interventions to target HCP forgetfulness alone. The comprehensive barriers identified in this study have the potential to facilitate intervention development to address the current evidence-practice gap. With implementation strategies, the intervention may help to bring sustained long-term improvement in clinical practice, which has not been achieved by the existing interventions.

The lack of clear guidance on 'when the catheter should be removed' is seen as a grey area by the study participants. The implication for local and national (UK) clinical guidelines is to provide more definitive parameters on the timing of catheter removal. Guidelines could be designed to be more similar to those outlined in the American CDC guidance, necessitating amendments to current guidance to provide clear instructions to clinicians specifying the timing of catheter removal (within 24 hours) or well-defined clinical indications for their continued use.

Future research

The findings presented here are of an exploratory and interpretive nature and highlight a number of opportunities for future research, both in terms of 1) addressing variations in care, and 2) breaking down the identified barriers to target this important clinical problem with a behaviour change intervention. The barriers investigated with the use of the TDF provided a theoretical base to move the findings forward, whereby key domains related to the identified barriers can be mapped onto specific behaviour change techniques that are likely to influence catheter removal behaviour and facilitate the selection of components of a theory-driven intervention. To inform scalability and generalisability in a wider setting, future research could involve conducting a survey to assess which theoretical constructs best predict catheter duration. The results from this interview study could be triangulated with questionnaire responses completed by HCPs on a larger scale to assess further generalisability of results and target a large scale, national quality improvement initiative.

The results of the study reported in this chapter also highlight the need for exploring patient engagement and the role of patients in the catheter removal process. The study participants identified several patient-related factors which affect the timing of catheter removal, such as reminders from patients and their willingness to have their catheter removed promptly. Therefore, with a joint rounded approach, recognising patient involvement as a key stakeholder is vital, and should be considered as an important component for an intervention to improve their safety and health outcomes. The prospect of increasing patient involvement in the catheter removal process may also bring about a reduction in CAUTIs. This avenue was pursued in this doctoral research programme, via conducting a separate interview study with patients, and is presented in chapter five.

4.6 Conclusion

This study explored barriers and enablers to the timing of catheter removal in a TDF-based interview study with HCP, in addition to a review of the related current guidance. The key barriers were identified within ten TDF domains and enablers within four TDF domains. There was an overlap between two domains; *Social influences* and *Emotion*, which identified barriers as well as enablers.

The sub-themes related to barriers identified: an absence of local guidelines on catheter removal, national guidance being poorly defined/vague and insufficiently known by HCPs, a lack of microbiological knowledge (evidence-base) for CAUTI development in relation to prolonged catheter duration (*Knowledge*); a hierarchy in the catheter removal decision-making process adding complexity to the removal process (*Social/professional role and identity*); variations in current removal practice (midnight or 6am removal) compared to recommended behaviours in existing guidance (*Nature of the behaviour*); nurses' inability to make catheter removal decisions (*Beliefs about capabilities*); patients' dependence on catheters and using the catheter as a device of convenience for both staff and patients (*Beliefs about consequences*); competing demands affecting HCPs' motivation to promptly remove catheters (*Motivation and goals*); forgetfulness to remove catheters, competing demands affecting decision processes resulting in catheter removal being perceived as a low priority task (*Memory attention, and decision processes*); ward layout, availability of toilets and patients requiring staff assistance after catheter removal in relation to low staff levels (*Environmental context and resources*); staff attitudes to obtain catheter removal order, ward culture and patient/family influence (*Social influences*); and indifference to prolonged catheter removal (*Emotion*).

The sub-themes related to key enablers were identified in four domains: HCPs being highly skilled at removing catheters and perceived good communication and interpersonal skills to promote prompt catheter removal (*Skills*); the use of handover notes, daily task lists, and verbal reminders from colleagues and sometimes patients helped in prompt removal (*Behaviour regulation*); senior and specialised colleagues as role models and patients' involvement in prompt removal of catheter (*Social influences*); and positive emotions related to job satisfaction generated by removing the catheter promptly (*Emotion*).

The study data can help clinicians, implementation researchers, and policymakers develop a tailored, behaviour-change intervention and implement strategies to improve quality of care by addressing the barriers identified in this study while enhancing the enablers.

4.7 Link to other chapters

- This work highlighted the need for further qualitative research to:
    - Determine patient engagement behaviours related to the timing of catheter removal (chapter five)
    - Cross-validation of patient-related factors highlighted by HCPs in the current study on timing of catheter removal (chapter five)
- Possible intervention development strategies to address identified modifiable barriers on to for future research work (chapter six)

Chapter 5. Barriers and enablers to patient engagement behaviours for the prompt removal of urinary catheters: A Theoretical Domains Framework-based interview study with hospitalised patients

5.1 Abstract

Background

Reducing catheter-associated urinary tract infections (CAUTIs) takes priority in the worldwide drive to reduce hospital-acquired infections. Prolonged catheter duration increases the risk of bacterial colonisation (day-by-day), which is associated with a higher risk of CAUTI. Early catheter removal can effectively reduce CAUTIs, but the current median duration of UK postoperative catheterisation remains higher than the recommended standard. A theory-based approach to understanding barriers and enablers to patient communication behaviours may facilitate prompt catheter removal and reduce CAUTI incidence.

Methods

A qualitative study with hospitalised patients from medical and surgical wards in the North East of England, requiring short-term catheterisation (≤14days). The interviews were semi-structured designed with the use of the Theoretical Domains Framework (TDF) and conducted on a one-to-one basis.

Results

A number of barriers were identified within the 12 domains of the TDF. Two domains: *Beliefs about consequences* and *Social influences* identified both barriers and enablers. The findings showed that patients do not routinely engage with their health care professionals (HCPs) for catheter removal (*Nature of the behaviour*). Nine domains identified further barriers: a lack of knowledge around functionality and risks from catheterisation (*Knowledge*); the perceived patient role and hierarchy amongst HCP roles in making catheter removal decision (*Social/professional role and identity*); a lack of confidence to ask questions and inability to manage without a catheter (*Beliefs about capabilities*); a catheter being perceived as an object of convenience (*Beliefs about consequences*); the patient's decision to delay asking questions related to staff members' attitudes and their competing demands (*Memory, attention and decision processes*); the availability and distance to the toilets in relation to a patient's reduced mobility (*Environment*); staff shortages (resources) to assist patients with toileting needs (*Environmental context and resources*); family influence, social pressure from fellow patients and HCPs' competing demands, hierarchical structure amongst staff (*Social influence*); anticipated regret and negative emotions if suffered from catheter infection due to lack of

engagement (*Emotion*); and, finally, the 'to whom' and 'when' context regarding engaging with staff (*Behaviour regulation*). Four domains identified enablers to patients' general engagement behaviour. These were: interpersonal skills i.e. a good rapport with staff (*Skills*); positive outcome expectancies (*Beliefs about consequences*); motivation to ask questions if the patient wanted to speed up their discharge process or experienced difficulties with their catheter (*Motivation and goals*); and social support from the family (*Social influence*).

Conclusions

This study identified a range of barriers and enablers to patient engagement with HCPs regarding their catheter removal. These barriers can inform the basis for developing a targeted behaviour change intervention, to encourage and empower patients to remind HCPs, for timely catheter removal and to enhance their safety while in hospital.

5.2 Introduction

Urinary tract infections (UTIs) are one of the most prevalent types of healthcare-acquired infections (HAIs) (Zarb *et al.*, 2012; Magill *et al.*, 2014) accounting for 19% of HAIs. Between 43-56% of UTIs are associated with a urinary catheter (Hopkins, 2012). Catheter-associated urinary tract infections (CAUTIs) are a considerable burden on patients, causing distress, discomfort and avoidable morbidity. Furthermore, they are a burden on the healthcare system, leading to a substantial, yet avoidable, financial impact on resources for: diagnostic tests, antibiotic treatment, length of hospital stay, added staff costs and treatment of sepsis in severe cases (Pickard *et al.*, 2012b).

The effects of CAUTIs appear to be more significant in older patients, causing problems such as confusion, cognitive impairment and delirium; these can increase distress, not only for patients but also for relatives and healthcare professionals (HCPs) (Petrino *et al.*, 2018; Lo *et al.*, 2014). Delirium can be misdiagnosed as symptoms of dementia/cognitive impairment (Yoshikawa, 1984; Inouye *et al.*, 1990). It can significantly increase comorbidities via loss of bladder control, increased risk of falls with subsequent complications such as fractures and cerebral bleeding (Petrino *et al.*, 2018). All of this reduces overall patient confidence, causes delays in returning to baseline activities and increases functional dependence on discharge which can result in altered discharge destination and increased mortality (Muzzi-Bjornson and Macera, 2011; Wise, 2002; Bader *et al.*, 2017).

The implementation of three key infection prevention strategies as per the epic3 evidence-based guidance statements on urinary catheters (UC) i.e. avoidance of catheter use by using alternative methods (statement UC1), aseptic catheter insertion (statement UC7), and shortened duration of catheterisation (statement UC23) (Loveday *et al.*, 2014) have been associated with a 50% reduction in hospital CAUTIs (Dudeck *et al.*, 2011; Burton *et al.*, 2011; Lo *et al.*, 2014). Long periods of catheterisation increase the chances of developing infection by approximately 5% per day (Gokula *et al.*, 2004; Fukuoka *et al.*, 2018). Reducing catheter duration is, therefore, an effective strategy to reduce infection risk. However, adopting guidance to safely remove a catheter early requires a multifaceted and collaborative approach to understand factors that may interfere with or support adoption from the perspective of

both HCPs (care providers) and patients (care receivers) to change current ways of practice (Yokoe *et al.*, 2014; Lo *et al.*, 2014; Mullin *et al.*, 2016).

The launch of the Institute of Medicine's report on medical errors '*To Err Is Human*' pioneered the modern patient-safety movement towards building a safer health system by avoiding medical errors (Kohn *et al.*, 2000). Since then, increased pressures have been posed on healthcare organisations, such as robust accreditation standards and increased requirements for error reporting, to enhance patient safety (Wachter, 2009). A vast amount of research has been conducted in the fields of patient engagement in preventing errors and for improving the quality of care (Armstrong *et al.*, 2013). Patient engagement and shared-decision making have been increasingly recognised as a means to improve patient safety and have been shown to be beneficial in reducing harm (Longtin *et al.*, 2010; Schwappach, 2010). The research suggests that engagement and patient-centeredness in a healthcare system can only be achieved if shared-decision making is acknowledged and supported mutually by HCPs and patients (Vaismoradi *et al.*, 2015). A narrative review highlights patient empowerment as the key component to enable shared and more equitable decision-making in the design, planning and co-production of healthcare, enabling patients to raise concerns and ask questions about their care (Ocloo and Matthews, 2016). The quality improvement initiatives are more likely to be successful and sustainable if patients have been involved in the design and implementation of interventions as key stakeholders (Health Foundation, 2013) as demonstrated in a Kidney Quality Improvement initiative in a renal clinical setting (Ormandy *et al.*, 2015; Wells and Lipkin, 2016).

Findings from a systematic review, which included 17 empirical research papers (four qualitative, one mixed-method and 12 quantitative studies), showed that patients are generally able and willing to take part in patient safety initiatives given that patients have sufficient knowledge about their condition and the care they receive to participate (Vaismoradi *et al.*, 2015). The authors used the theoretical domains of *"Vincent's framework for analysing risk and safety in clinical practice: 'patient', 'healthcare provider', 'task', 'work environment' and 'organisation & management'"* (Vaismoradi *et al.*, 2015, p.627). The findings also highlighted that nurses' positive attitudes and support are important elements in order to encourage patients to take part in safety measures. The findings also highlighted that nurses' positive attitudes and support are important elements in order to encourage patients

to take part in safety measures. The review highlights the significance of the patient's role in enhancing patient safety when hospitalised and recommends further research to explore patient engagement in different disciplines, contexts, and cultures (Vaismoradi *et al.*, 2015). This concept has been successfully applied to various patient care settings such as hand-hygiene practices for infection prevention (Landers *et al.*, 2012) and shared decision-making in managing long-term conditions (Friesen-Storms *et al.*, 2015). However, the patient's role and their engagement in the context of the catheter removal process is yet to be explored.

Thus far, it has not been fully established whether or not patients are engaging with their HCPs regarding their catheter removal. Given the benefits of patient engagement highlighted in the previous research, patients may be well placed to engage in this role to increase their catheter-related safety. The literature has identified barriers and enablers to patients being involved in their care more generally. For example, a lack of sufficient knowledge and self-efficacy beliefs act as barriers (Kosteli *et al.*, 2017) and support and positive attitudes from HCPs (Vaismoradi *et al.*, 2015) act as enablers to patient engagement. However, we do not know what the unique barriers and enablers are that relate to the catheter removal setting. Therefore, barriers and enablers to patient engagement need to be explored further to empower patients to prompt their HCPs about early removal of their catheter, in order to reduce the risk of developing CAUTIs.

The current study aimed to explore patients' views on engaging with HCPs by asking questions and initiating a catheter removal conversation for the prompt removal of their catheter. Of the three evidence-based prevention strategies in the epic3 guidance listed above (Loveday *et al.*, 2014), the focus of the current study was to understand the process of reducing the duration of catheterisation from the perspective of patients, how they might be involved in the catheter removal procedure, and what factors they perceive may act as barriers or enablers to their involvement.

This study had three research objectives: 1) to establish the degree in which patients routinely engage with HCPs about their catheter removal (prevalence of the target behaviour), 2) to identify the perceived barriers, and 3) to identify enablers to the engagement with HCPs from patient participants' perspectives. This chapter reports one of two studies conducted to understand barriers and enablers to prompt catheter removal practices, one from HCP

perspectives (chapter four), and a second on engagement with the catheter removal process from the patient's perspective. The patient interview study has been described in this chapter.

5.3 Methods

This was a qualitative study involving hospitalised patients using one-on-one, semi-structured interviews designed using the Theoretical Domains Framework (TDF). This study has been reported as per the 'consolidated criteria for reporting qualitative studies' (COREQ) (Tong *et al.*, 2007). Some of the study methods and procedures were similar to the HCP interview study, as detailed in chapter four. A short summary of the methods explained in detail previously is presented below.

5.3.1 Target behaviour and development/piloting of the interview schedule

The study interview schedule was developed using the generic questions outlined in the TDF (Michie *et al.*, 2005) (see Appendix B) and were adapted to the specific target behaviour in terms of the target, action, context, time and actor (TACT-A) principle (Fishbein, 1967; Francis and Presseau, 2019) (see Appendix H). The study 'Target' was 'HCPs involved in catheter care and removal process', the 'Action' was 'asking HCP questions about catheter removal', the 'Context' was 'during hospital admission' the 'Time' was 'from 24 hours after the catheter insertion' and the 'Actors' were 'hospitalised patients requiring short-term catheterisation (≤14 days)'. The topic guide included prompts where necessary. The draft topic guide was piloted with two individual patients for face validity, relevance and acceptability of questions.

5.3.2 Setting, participants and recruitment procedures

The participants were recruited from a large, secondary care UK National Health Service (NHS) teaching hospital, based in the North East of England. Sampling was guided by the eligibility criteria (Martínez-Mesa *et al.*, 2016). The eligibility criteria were adult hospitalised patients (aged ≥16 years) requiring planned or unplanned short-term (≤14 days) catheterisation and admitted to either medical or surgical wards. Indications for planned and unplanned catheter insertion were recorded in patients' clinical notes. Examples of indications for planned catheterisations were peri-operative (during surgery) or fluid output monitoring. Examples of indications for unplanned catheter insertion indications were: acute urinary retention, reduced mobility, and catheterisation when admitted via the emergency department. A

recruitment poster was displayed on the wards making patients aware of the study (Appendix I).

Study participation was voluntary. A participant information sheet (PIS) was provided to eligible and interested participants (see Appendix J). Participants provided written informed consent to take part in the study and audio record the interviews (see Appendix K). A copy of the consent form was provided to the participant, further copies were filed in both their clinical notes and in the investigator site file. Interviews were confidential and conducted in a quiet room on the participant's ward of admission. During the interview, no one else was present apart from the participant and the interviewer (Rashmi Bhardwaj-Gosling (RBG)). The interviewer is an experienced clinical researcher who is trained in taking research consent and conducting interviews with patients and has a specific research interest in the reduction of catheter-associated infections. The interviewer was a female who consented and interviewed all study participants in a research capacity. There was no clinical relationship between the study participants and the interviewer before, during or after the study.

5.3.3 Data collection, sample size and saturation

Interviews were conducted between May and August 2014, carried out on a one-off basis and audio recorded to be transcribed for data analysis. No identifiable data was collected on the recorded interviews. Field notes were made by the researcher immediately after the interview. Interviews were planned to last for approximately an hour. Data saturation was estimated on all domains within 20 interviews with the application of the 10+3 method until no new issues were raised by the study individuals (Francis *et al.*, 2010).

5.3.4 Data analysis

Interview recordings were labelled with participants' unique study number to maintain anonymity and transcribed verbatim by an external company (UK Transcription). Transcripts were stored on Newcastle University's secure IT server. NVivo10 software (QSR International Pty Ltd.) was used to organise and analyse transcribed data (Castleberry, 2014).

Content analysis was used to analyse interview transcripts (Elo and Kyngäs, 2008). This is a typical analysis approach to TDF or framework based studies (Atkins *et al.*, 2017). Birken *et al.* provide a list of framework-based studies that used the content analysis approach (2017). Of

three potential approaches to content analysis (conventional, directed, and summative), directed content analysis was the most suitable option (Hsieh and Shannon, 2005); as it provides a deductive approach that draws on an existing theory or a theoretical framework (Mayring, 2000; Vaismoradi *et al.*, 2013) such as the TDF used in the current study (Michie *et al.*, 2005). The statements were coded within the TDF at the domain level, where each of the TDF domains served as a label for *a-priori* themes in the initial coding process (Elo and Kyngäs, 2008; Ryan and Bernard, 2003). Similar statements were grouped within the domains. Statements with an overlap between two different domains were double coded (Patey *et al.*, 2012). Once the interview content was coded to the TDF domains, sub-themes were inductively generated and results were nested under relevant domains to develop a context-specific description of the barriers and enablers within each domain (Braun and Clarke, 2006).

The interviewer was also the primary coder and conducted the data analysis. Therefore, the initial familiarisation stage began at the data collection stage. To improve the coding consistency, initial codes were double coded by an independent second coder Dr Suzanne McDonald (SMc) who is a health psychologist with expertise in the conduct and analysis of TDF-based interviews. The second coder was blinded to the domains under which the transcripts were initially coded by the primary coder. Agreements and disagreements between the two coders were discussed and resolved in face-to-face meetings. Furthermore, sub-themes were inductively generated by RBG and cross checked by Dr Samuel Ginja (SG); a health psychologist with expertise in behaviour change methods and TDF-based interviews.

5.3.5 Patient and public involvement (PPI)

For patient representation and input on the study, a PPI panel consisting of five members was appointed through NIHR INVOLVE North East (http://www.invo.org.uk). The members had a study-specific induction during the initial meeting. A role description was provided for clarity on their role and project goals (Buck *et al.*, 2014). Members were lay experts with previous experience of urinary catheterisation. Subsequently, PPI group meetings for updates on study progress and 'Think Aloud' sessions at the document design stage were held periodically. The members provided their input in improving the draft patient participant information sheet and interview topic guide in terms of design, layout, and structure of these documents. PPI members facilitated pilot testing the draft interview topic guide for relevance, flow, and clarity of the interview questions, and to make sure the interviews were not too onerous for study

participants in terms of the burden on their time and health. The group also helped in the cross-checking of interim findings for more accurate interpretation of study participants' accounts (Barbour, 2001).

The PPI members helped to publicise the research while in progress and dissemination of research findings towards the end to a wider audience and specific patient groups. These included a 'Peer to Peer PPI Support Group', manning study stands at several local and regional PPI awareness and training events, co-writing conference abstract for the NIHR INVOLVE @21 Research Conference, presenting in a joint oral presentation at NIHR SPCR (School of Primary Care Research) PPI Conference in Newcastle which won the first prize for 'Best Oral Presentation' titled: *"Innovative ways of involving PPI in your research"*, and proofreading of funder's final report. Future PPI activities are planned and patient partners will be involved in co-authorship on publications from this research.

5.3.6 Ethical and institutional approvals

The research study was approved collectively as part of the REDUCE project (reducing the duration of urinary catheters including both patient and healthcare professional studies), by a UK NHS Research Ethics Committee (reference number 13/WM/0460) and by the host NHS institution (reference number 6649) along with approval from the Ethics Committee at Newcastle University. The study was adopted by the National Institute for Health Research (NIHR) Clinical Research Network Portfolio (reference 15750) and approved by the host organisation's Caldicott and Data Protection Guardian team.

5.4 Results

5.4.1 Sample characteristics

A total of eight male (62%) and five (38%) female participants aged (median=72; range 19-92 years) with diverse catheter indications were interviewed and included in the study analysis (see Table 5.1). The participants were recruited from eight surgical and five medical speciality wards. There were seven (54%) elective and six (46%) acute indications for catheterisation. Surgical indications for catheter insertion included: elective robotic prostatectomy, debridement of a scrotal abscess, transurethral resection of the prostate, urinary retention, cardiac graft and cardiac valve replacement, corrective surgery for pectus excavatum, open

heart bypass, and post-surgical fluid monitoring. The medical indications for catheter insertion included a fractured pubic rami, unsteady gait requiring assistance for toileting, reduced mobility due to a fractured neck of femur. Catheter duration in days ranged from 1-14, median= 5. Only three patients had a documented length of catheterisation in their clinical notes that was pre-planned to be longer than 24 hours. Of 13 patient participants, only one participant had their catheter removed within the 24 hours as recommended by the CDC guidance (Gould *et al.*, 2010). The remaining nine participants did not have a written clinical indication to justify continued catheter use beyond 24 hours.

Table 5.1: Characteristics of patient participants

Participant	Gender	Age	Ward	Reason for admission	Planned catheter duration (days)	Actual catheter duration (days)
1	Male	68	Surgical	Elective	7	11
2	Male	59	Surgical	Elective	Not specified	1
3	Male	77	Surgical	Elective	2	3
4	Male	71	Surgical	Elective	Not specified	4
5	Male	70	Surgical	Elective	Not specified	7
6	Female	26	Surgical	Acute	Not specified	3
7	Male	19	Surgical	Elective	Not specified	5
8	Male	46	Surgical	Elective	2	4
9	Female	92	Medical	Acute	Not specified	14
10	Female	92	Medical	Acute	Not specified	3
11	Female	78	Medical	Acute	Not specified	7
12	Female	88	Medical	Acute	Not specified	13
13	Male	83	Medical	Acute	Not specified	5

Ten interviews were conducted in the first instance, followed by three consecutive interviews. The final three interviews did not bring up any new concepts related to the 12 domains, thus, data saturation was considered to have been achieved following the approach set forth by Francis *et al.* (2010). Interview transcripts were initially coded within 12 domains of the TDF, followed by secondary coding by an independent coder. See Appendix L for a summary of agreements and disagreements between the primary and secondary coders. The relevant set of subthemes were generated within the 12 TDF domains to meet each of the three research objectives. *Nature of the behaviour* established the prevalence of the target behaviour i.e. the degree in which patients routinely engage with HCPs regarding their catheter removal (objective 1). Eight domains identified the barriers related to patient engagement to catheter removal (objective 2): *knowledge*, *social/professional role and identity*, *beliefs about capabilities*, *beliefs about consequences*, decision processes (*Memory, attention and decision processes*), *environmental context and resources*, *social influence* and *behaviour regulation*. Four domains identified the enablers to patient's engagement behaviour (objective 3). These were *skills* (interpersonal skills, i.e. a good rapport with staff), *beliefs about consequences* (positive outcome expectancies), *motivation and goals,* and *social influence* (however, only the social support construct). Two domains: *beliefs about consequences* and *social influences* identified both barriers and enablers. Conceptual maps of the TDF domains and relevant sub-themes for each of the research objectives are shown in Figure 5.1 (objectives one and two: prevalence of target behaviour and barriers) and Figure 5.2 (objective three: enablers). A relationship between the domains was evident as summarised in Table 5.2.

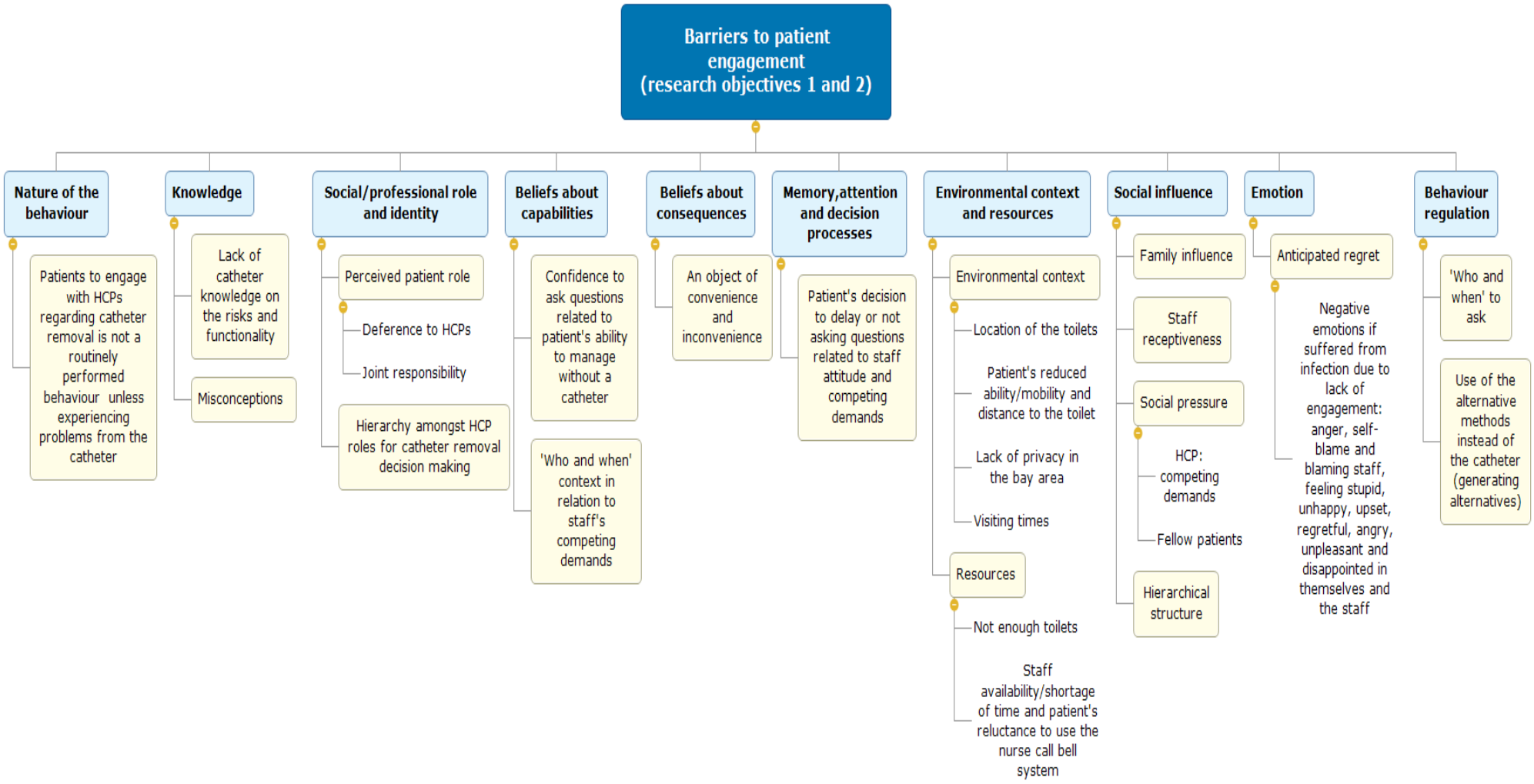


Figure 5.1: Conceptual map- the prevalence of, and barriers to, patient engagement behaviour

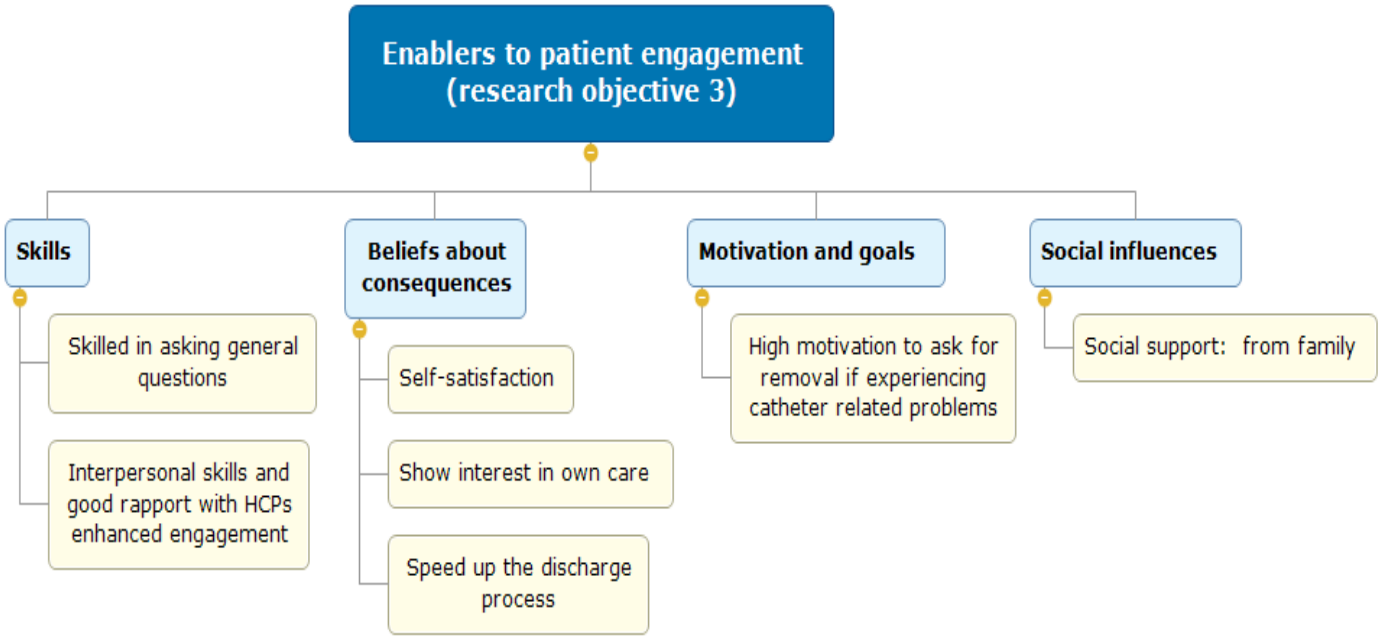


Figure 5.2: Conceptual map of enablers to patient engagement

Table 5.2: Summary of key theoretical domains, subthemes and relationships with other domains

Research objectives (ROs)	TDF domain	Sub-themes	Links with other domain/s
RO1: Prevalence of the target behaviour	**Nature of the behaviour**	Asking about catheter removal is not a routine practice for patients	Social influences - Staff members' approach - Professional boundaries role - Competing demands (staff) Behaviour regulation
RO2: Barriers to patient engagement	**Knowledge**	Lack of prior knowledge about catheters, the risks and functionality	Environmental context and resources Resources: (lack of explanation/consent due to HCP time constraint)
		Misconceptions due to lack of knowledge	Lack of explanation due to staff time constraints (resources) Beliefs about consequences
		Lack of knowledge about the risks of prolonged catheter duration	Lack of explanation due to staff time constraints (resources) Beliefs about consequences
	Social/professional role and identity	Perceived patient role	Beliefs about capabilities (of HCP)
		Deference: not wanting to question the professional capabilities of HCP	Beliefs about capabilities (of HCP)
		Prompts if necessary (to overcome HCP forgetfulness)	Memory (of HCPs)
		Joint responsibility	n/a
		Hierarchy amongst professional roles	Social influence (hierarchy)

Beliefs about capabilities	Confidence to ask questions related to willingness and capability to manage without a catheter	n/a
	'to whom' and 'when' context in relation to staff's competing demands	'to whom' overlapped with social influence (staff attitudes) 'when' overlapped with environmental context and resources (staff availability) and had an overall influence on behaviour regulation
Beliefs about consequences	Inadequate engagement due to lack of understanding of the risks of prolonged catheter duration (outcome expectancies)	Lack of knowledge (knowledge)
	An object of inconvenience and convenience	Beliefs about capabilities
Memory, attention and decision processes	Memory and attention were not a barrier	n/a
	Patient's decision to delay or not asking questions was affected by the staff's approach and their competing demands	Decision to delay (behaviour regulation) Competing demands and staff approach (social influences)
Environmental context and resources	**Environmental context**	
	Location of the toilets	n/a
	Reduced ability/mobility and distance to the toilet	Distance to the toilet (environmental context) linked to the patient's reduced mobility (beliefs about capabilities)
	Lack of privacy	Linked to the use of alternative methods (behaviour regulation) instead of having a catheter
	Visiting times	n/a

		Resources	
		Not enough toilets	n/a
		Staff availability/shortage of time and patient's reluctance to use the nurse call bell	Social influence (social pressure) for not wanting to come across demanding by using the call bell
	Social influences	Staff's receptiveness	Behaviour regulation, beliefs about capabilities
		Social pressure concerning HCPs and other patients	Behaviour regulation
		Hierarchy around catheter removal decision	Social, professional role and identity (HCP)
	Emotion	Anticipated regret: negative feelings	Knowledge (Lack of knowledge)
	Behaviour regulation	'to whom' and 'when' to ask context	'to whom' overlapped with social influence (staff approach) 'when' overlapped with environmental context and resources (staff availability), avoided busy times to ask questions (behaviour regulation)
		Use of alternative methods instead of having a catheter (generating alternatives)	Environmental context (lack of privacy)
RO3: Enablers to patient engagement	**Skills**	Asking questions about catheter removal	Social Influences (staff's approach)

	Asking questions in general	
	Interpersonal skills (good rapport with staff)	
Beliefs about consequences (positive outcome expectancies)	Self-satisfaction Show interest in own care Speed-up the discharge process	Motivation and goals (intention to ask questions)
Motivation and goals	High motivation (certainty of intention) to ask for removal if catheter caused problems (pain, discomfort, infection)	n/a
Social influence	Support from the family (social support)	Beliefs about capabilities

5.4.2 Research objective one: prevalence of the target behaviour

Nature of the behaviour

This domain established that participants generally do not engage with their HCPs about catheter removal unless they experienced problems from the catheter such as pain or discomfort, the catheter bag needing emptying, or if they wanted to speed up their discharge process. The lack of engagement linked in with their motivation to ask (*Motivation and goals*). Otherwise, they did not see any reason for asking questions about their catheter removal routinely.

"If I was in pain because of the catheter, it would be different, I would find it quite easy to ask. I'm not the type of person to complain, but if I'm in pain I need it out. Asking for it out would then justify it more" (P08).

"I asked the question to have it out, to speed my recovery and get home quicker" (P06).

However, participants did report engaging with HCPs on more general issues such as asking for pain medication and activities of daily living but chose carefully whom they asked (staff members' attitude- *Social influences*) and the time at which they asked (*Behaviour regulation*). The majority of the participants understood catheter removal as solely the responsibility of HCPs (professional boundaries role- *Social influences*) and did not want to disturb staff to ask questions on general issues when they were busy with other tasks (competing demands- *Social influences*).

"No, I never asked them any questions about when it will come out. I just took it as read that staff would remove it when the time was right" (P13).

"How I interact routinely depends on staff's (sic) attitude and who it is. It also depends on the time of the day. They get irritated if you ask when they are busy. That's why I try to choose my time carefully" (P07).

5.4.3 Research objective two: Barriers to patient engagement

Knowledge

Sub-theme 1: Lack of knowledge about the risks and functionality of urinary catheters

Five participants did not have prior knowledge of receiving a planned urinary catheter during their surgical procedure. Seven participants were informed by the staff about receiving a catheter but did not receive information on the purpose of having a catheter, its functionality, estimated duration, or the link between longer duration and increased infection risk associated with having a catheter in-situ. Only one participant knew about CAUTI risk through suffering from a previous catheter infection.

"None at all. I just woke up, and that's it; there it is. C'est la vie. You're stuck; you've got it. Nobody explained how it was going to function, how you had to take care of it, what are the risks, nothing. No information like that at all" (P13).

"I didn't receive very much information when I got my catheter or about the risk of getting an infection with having it in for longer periods of time. Staff are ought to tell patients about all the risks and benefits of any procedures they do with patients. But, sometimes they haven't got time" (P11).

"They told me that I would get one (catheter) before the surgery, but they didn't say anything else about it" (P08).

Participants' viewpoints were that they should be made aware of the risks for them to actively ask questions to speed-up their catheter removal.

"Education is a wonderful thing. If I had been told about the risks beforehand and what happens when the catheter is inside my body, I would be asking them every day until it was out. But if you don't know anything, you are not doing anything wrong, are you?" (P03).

Sub-theme 2: Misconceptions

Participants believed that the lack of explanation from the staff was due to time constraints (*Environmental context and resources*). Due to a lack of knowledge, the participants had misconceived ideas about catheters which in turn affected their beliefs about consequences of having a catheter. For example, one participant perceived that the catheter was curing their illness and another participant believed that receiving a catheter when admitted to hospital is an essential procedure that every patient has to go through. These misconceptions contributed towards participants not asking questions about their catheter removal.

"This is the first time I have learnt that a catheter doesn't cure you. If it doesn't cure you, what's it there for? I thought it was doing me good to improve my health. That's why I didn't ask anyone about it coming out" (P05).

"*Catheter is a necessary evil when you are in hospital"* (P12).

Sub-theme 3: Lack of knowledge about the risks of prolonged catheter duration

Twelve out of 13 participants were not informed by the HCPs about the link between longer catheter duration and increased risk of developing a CAUTI. The lack of knowledge about the risks affected participants' beliefs about consequences. None of the participants knew about the association between longer catheter duration and increased risk of developing a CAUTI, consequently, they were not concerned about the consequences of delayed removal.

"Well, they didn't tell me a great deal about the catheter really or about any risks. As far as I was concerned it was doing me a favour by taking water (urine) out of my bladder and flowing which was causing me pain when I couldn't pee" (P10).

"I don't want a urinary infection; well I just simply don't want a urinary infection. I don't know sufficient about the use of catheters, risks and the ins and outs of all that, it's just how long it should stay in before you get an infection" (P04).

Social/professional role and identity

The lack of engagement about catheter removal in most participants was due to not being aware of a need to ask about their catheter. A majority of participants reported reticence to engage in asking questions about catheter removal; this was based on hypothetical rather than the actual experience.

Sub-theme 1: Perceived patient role

This subtheme included deference to HCPs, patients' perception was that it was not their place to challenge professionals and the belief of joint responsibility for timely catheter removal. There were perceived boundaries around the role of a patient, who did not want to question the professional capabilities of HCPs (beliefs about capabilities) unless there was a problem with their catheter.

"I would rather not ask and let them decide when it can come out" (P02).

"I couldn't and wouldn't ask about my catheter removal as it would question the capabilities of the medical team in that. It is up to the medical staff to say if and when that catheter is removed" (P03).

"Well, at the end of the day, it's a joint responsibility" (P06).

In contrast, a minority of patients understood making decisions about the timely removal of the catheter as a joint role and said prompts from patients would be effective especially when staff forget to remove the catheter (*Memory, attention and decision processes*).

"My view is that it shouldn't be [the] patient's role to keep reminding staff, but because of the pressure of other work that staff has to go through, for my own sake its helpful to remind them when they get busy with other things" (P04).

Sub-theme 2: Hierarchy among professional roles to catheter removal decision-making process

The participants' general preference was to ask medical over nursing staff, acknowledging hierarchy amongst professional roles around catheter removal decision-making (*Social influences*).

"I wouldn't necessarily ask the nurse, but certainly ask someone senior like the ward sister, who has more of a command of situations, who then probably needs to ask the doctor anyway. There's so much hierarchy to this" (P11).

Beliefs about capabilities (self-efficacy)

Sub-theme 1: Confidence to ask questions in the context of a patient's ability to manage without a catheter

The participants felt that they were capable of asking questions in general. But their willingness and capability to ask specific questions about catheter removal were reliant on confidence. The confidence level was dependent on the participant's ability to manage without a catheter considering factors like mobility and post-operative pain. The participants felt more confident to ask once they had recovered from the initial post-operative period and their mobility was improved.

"Some people have more confidence than others. So it depends on the individual, if you're going to be confident to go to the toilet without the catheter then you will be confident to ask questions for it to be taken out" (P12).

"Well, it was difficult for me to get in and out of bed because I've just had this big operation, and I was feeling a lot of pain. That's why I didn't want to ask about getting my catheter out" (P12).

"How long is a piece of string? …Especially after surgery, it's just a case of mobility, being able to get up and safely go to the toilet, at least with assistance before you can ask" (P06).

Sub-theme 2: Patient self-efficacy related to 'to whom' and 'when' context and staff's competing demands

Participants' general engagement depended on the circumstantial context in terms of 'to whom' and 'when' they asked, which was related to the staff member's manner (*Social influence*) and appeared to be a way of regulating their asking behaviour (*Behaviour regulation*). HCPs busy with other tasks were perceived by participants as more important (for example, looking after another ill patient) which discouraged or delayed patients from asking questions.

"I don't think it would be difficult to ask but it depends on who do you ask and when do you ask" (P10).

"If I did press the button, they would come in and say, "Well you have to just wait a minute or two, I'm busy with somebody else." Which could be much more important than my question" (P10).

"If staff as they have been today been looking after obviously more seriously ill patients than I am, then I would not ask or I'll bide my time until a reasonable moment came along to ask" (P04).

Beliefs about consequences

Sub-theme 1: An object of inconvenience and convenience

The participants believed catheters to be an object of both convenience (for staff and patients) and inconvenience (patients). The presence of a catheter was described by some participants to have caused inconvenience due to having an impact on their independence, mobility and prompt discharge from the hospital. Other participants viewed it as an object of convenience to themselves, for not having to walk to the toilet in the context of post-operative pain and reduced mobility (*Beliefs about capabilities*); and for staff, by not having to provide patients with the assistance to go to the toilet.

"It's just another encumbrance in the bed – you can't turn over independently, because you are wired up with a catheter and other things. It's stopping me from moving about and going home" (P04).

"I just felt that it was a hindrance, and I felt that my body was ready to perform normally" (P13).

"With my poor mobility, I think it was put in to make it easy for me to go to the toilet and its easier for the staff to leave it in than having to assist me all the time because I am quite big you know" (P11).

"It has saved me having to get somebody to help to take me to the toilet and bothering them all the time" (P12).

Memory, attention and decision processes

Sub-theme 1: Memory and attention

Memory and attention in relation to asking for catheter removal was *not a perceived barrier*. Generally, participants stated that once the catheter was in-situ, it was very difficult for them to forget about it, not only during the day but also through the night.

"When you've got one of these things in your willy, these don't slip your mind" (P01).

"There's no way you could ignore it or forget about it" (P05).

"I wouldn't forget about asking because I was getting sick of it. It was just a nuisance more than anything else. There might have been short term distraction in asking about it but not for very long" (P07).

Sub-theme 2: Decision processes

Participants' likelihood of asking catheter-related questions was found to be ad-hoc and depended on the needs and problems caused by it. The decision process to delay (*Behaviour regulation*) or not ask questions could be influenced by a patient's perceptions of staff member's response (*Social influences*) and their competing demands (*Social influences*).

"I would have no problem asking if I was asking the right person, who I felt comfortable with. Certain staff don't want to help you all the way. Its little things encourage or discourage you from asking" (P10).

"I always find people reasonable to approach if you approach them in the correct manner. But when they're very busy, I don't like to ask. I just wait for the right moment" (P04).

Environmental context and resources

Participants identified several barriers in the context of *Environmental factors and resources* to engage with HCPs for their catheter removal which affected their catheter duration.

Sub-theme 1: Environmental context

The barriers related to *environmental context* were: location of the toilets on the ward, distance to the toilet with reduced mobility (*Beliefs about capabilities* - self) when participants were unable to walk to the toilet due to pain after surgical procedure or urinary retention, a lack of privacy in the bay which discouraged participants from using the alternative methods like a commode or a bottle, and during visiting times participants preferred not to ask about their catheter removal.

"When I was suffering from my retention, this toilet (next to the bedside) *was busy and there's another one on the ward but it's down the corridor. I was going up and down this corridor in discomfort so I was desperate to have the catheter in"* (P04).

"There's no chance I could have walked that distance to the toilet when I was in pain. In that case, it was definitely too far" (P08).

"Those curtains aren't soundproof. I'd rather keep the catheter in for longer and be quite dignified and private, rather than using a commode when I'm perched on top of a bed on a pan having a wee when everyone else in my room can hear it tinkling" (P06).

"I'd delay the request of catheter removal if I had visitors. I wouldn't want to embarrass my visitors" (P13).

Sub-theme 2: Resources

The participants felt that there should have been more toilets in the near vicinity to their bed space. Participants described barriers to be insufficient toilets on the ward to serve both patients and visitors and intermittent availability of staff to assist them to the toilet. There was one toilet to be shared between six patients. The visitors are supposed to use the dedicated visitor's toilet, generally located off the ward. However, for convenience sake, at times visitors were also reported to use the patient's toilet.

"For six patients there is only the one toilet at the entrance. I think that's not enough. There should be another one nearby because this one is often occupied, especially during visiting hours as visitors use it as well" (P04).

Despite the nurse call bell system, intermittent availability and shortage of staff discouraged participants from actively engaging with HCPs to ask for assistance with toileting. Participants were reluctant to use the bell and did not want to cause an inconvenience to staff (social pressure/influence). Day and night shift patterns seemed to influence staff response time with night staff taking longer to respond to participant requests. These factors had an impact on the participants' preference to keep the catheter in-situ over the use of alternative methods (*Behaviour regulation*) or asking for prompt removal.

"There's never enough of them (staff) *to attend all of us in here. They are always busy and rushed off their feet. That's why I usually tend to wait until someone is in the room and I don't have to press the buzzer. I know that's a function that's encouraged to be used, but I don't want to come across demanding person who causes inconvenience. It's the matter of getting help without having to press the buzzer. So it's just easier just to have the catheter in until I can manage to walk to the toilet by myself" (P07).*

"Day staff is (sic) brilliant but night staff's response gets sluggish as they become weary by six o'clock. So I would avoid asking then" (P04).

"They are always busy to attend you because there's not enough of them. I put it down to the shortage of staff" (P10).

Social Influence (barriers)

Participants explained the influence of other people on their engagement behaviour (*Behaviour regulation*). Evidently, there were three kinds of influences reported, one of a personal kind from family and another two related to HCPs and fellow patients on the ward. The family's influence has been reported as social support (*Social influences*) in the enablers section.

Sub-theme 1: Staff's receptiveness

The participants reported that even when they were able to, they did not engage with HCPs at times. It was due to their perceived consequences of asking questions concerning staff receptiveness. The majority of the participants felt encouraged to engage with staff who had a polite and receptive manner except for of one participant who found it easier to ask questions of staff whom they did not get on with as previously reported in *Beliefs about capabilities* section.

"I'm not saying she's not a good nurse, would never dispute that fact. She is just absolutely abysmal at everything else that comes with it, like the way she communicates, my care, talking to the families, attitude. The whole lot of it's out the window. If I had my way, she wouldn't care for me because I wouldn't want her nowhere near, let alone asking questions. I would prefer to ask someone else" (P06).

"I'd say, it's easier for me to ask someone who I didn't like" (P01).

Sub-theme 2: Social pressure concerning HCPs and other patients

Participants delayed asking questions (*Behaviour regulation*) or chose not to ask at all while HCPs were busy with other tasks (*Social influences*- competing demands) as they did not want to cause an inconvenience to staff during busy times.

"Well, you see, in the mornings, they're so busy getting patients washed and all the rest of it. After lunch, they've got a lot of their jobs done. While they're busy washing patients, making beds, they've got their medication and doctor's rounds, and everything else to sort out. You can't ask questions then. I'd wait until a quiet time" (P12).

"The staff are too busy to answer our questions" (P10).

"I don't use the buzzer very much unless it's something serious. I don't like bothering them when they are busy. I just ask when they are around" (P11).

Social pressure from other patients in the shared bay was also a reason for being reluctant to use the nurse call bell system to ask questions.

"Some of the patients tut if you ring a buzzer. Alright, sometimes I can understand because there was one of the ladies pressed her buzzer at half-past 11 at night and the other lady was trying to get to sleep. You can get the sort of people that give you the look of, "What are you pressing your buzzer for and ask for things?" (P06).

Sub-theme 3: Hierarchical structure

Participants were aware of the hierarchical structure and a nurse's inability to make the catheter removal decision (*Social/professional role and identity*). One participant who queried about their catheter removal preferred to ask the medical staff to get an answer quickly.

"Well, I will ask more, but you feel that they (nurses and support staff) are so paltry really, they don't always have the authority to make the decision or have an answer for you. That's why I just ask the doctors and bypass them" (P10).

"I can ask nurses and they're really nice girls, but they say we will ask the doctor. So it's best to ask the doctors to start with" (P09).

"They (nurses) always have to ask the doctor in the end anyway so might as well ask the doctor" (P03).

Emotion

Sub-theme 1: Anticipated regret

Participants expressed that they would feel negative emotions if they did not engage with HCPs for prompt catheter removal and suffered from a catheter infection as a result. Feelings

expressed were: anger, self-blame and blaming staff, feeling stupid, unhappy, upset, regretful, angry, unpleasant, and disappointed in themselves and the staff. However, the responses were related to hypothetical questions representing anticipated regret. Emotions cross-linked with *Knowledge* (lack of knowledge) about the risks of prolonged catheter duration which caused negative emotions (anticipated regret) about the catheter infection; and *Social, professional role and identity* where participants expressed disappointment in staff for not doing their job properly to keep them safe from catheter infection.

"It would make me feel a bit uppity and regretful because it's been left in too long" (P11).

"It would feel really upset if I suffered from an infection and staff didn't tell me why it happened in the first place, and the fact it could've been avoided if it came out earlier" (P09).

"I would be pretty angry if I got an infection in my catheter because I didn't ask them enough or staff didn't do their job" (P13).

"I wouldn't feel particularly responsible for getting an infection in my catheter as staff should be doing what they are supposed to do to avoid infections" (P06).

"I'd feel a bit stupid, to be honest, if I got an infection and I didn't ask about getting it out in time" (P07).

"I would feel disappointed in myself that I hadn't asked, but also in the staff. At the end of the day, it's their job to keep me safe in here" (P03).

Behaviour regulation

Sub-theme 1: 'to whom and when' context to ask questions

The participants described a few approaches to regulate their behaviour in relation to asking HCPs general questions. These were to ask the appropriate HCP (*Social influence*) at an appropriate time avoiding busy times (*Behaviour regulation*) and asking when a member of staff was available in their vicinity (*Environmental context*). The participants preferred not to

use the call-bell for asking questions or assistance unless it was for something that they deemed urgent.

"I wouldn't necessarily ask the nurse, but certainly the ward sister, who has more of a command of situations, who then probably needs to ask the doctor anyway. There's so much hierarchy to this" (P11).

"Having met with an unreasonable staff attitude, I wouldn't go back to them, but I would go to someone else to ask" (P03).

"At busy times on the ward like dinner and visiting times, I would just keep it to the back of my mind and when everything's gone and then I would ask the nurse" (P12).

"It's easier to ask when I see one of the staff in my bay who's available. If I can catch somebody on… then I ask, otherwise, I just put it off" (P02).

Sub-theme 2: Use of alternative methods

The participants had mixed feelings about the use of alternative methods to encourage prompt catheter removal such as a bedpan, commode or urinal bottle. Some participants were open to using the alternative methods but others preferred to have the catheter in-situ due to having to ask staff for assistance for the toilet to use the alternative methods and also the lack of privacy in a shared patient area. For example, a 78-year-old female participant from the care of the elderly department with reduced mobility (the reason of catheterisation) expressed to use a commode as a preferred method instead of being mandated to have a catheter in-situ. Participants were not routinely presented with the choice between having a catheter and alternative methods. This was the same for another participant (83-year-old male) who mentioned that with the use of a bottle, their catheter could have been removed a day early. However, in contrast, a 26-year-old female participant preferred to have the catheter in-situ instead of asking to use an alternative method by their bedside.

"I couldn't manage to walk to the toilet quick enough so they put a catheter in. I would rather use a commode than have a catheter. But nobody (staff) offered it to me" (P11).

"*If they (staff) had given me a bottle, I could've peed in it instead to avoid having the catheter in for an extra day, as I felt, that the catheter could've come out a day earlier"* (P08).

"I would just keep the catheter in for another week if I couldn't walk for pain or any other reason. I'd rather have the catheter in for longer than asking to use something else, next to or on my bed" (P09).

5.4.4 Research objective three: Enablers to patient engagement

Skills

The participants reported that they were able to *ask general questions* about their care during the hospitalised period. Interpersonal skills to manage different staff attitudes and securing a good rapport with staff members (*Social influences*) played an important part in the participant's engagement skills. Participants generally felt encouraged to ask questions to staff with whom they had built a good rapport. However, there was an exception of one participant who found it easier to ask questions to staff whom they did not like.

"I have no problem asking questions in general" (P08).

"I would have no problem asking if I was asking the right person, who I felt comfortable with" (P10).

"I'd say, it's easier for me to ask someone who I didn't like" (P01).

Beliefs about consequences

Participants reported positive outcomes from asking general questions, such as to achieve self-satisfaction by acquiring knowledge, to show interest in their own care, to speed up their discharge from the hospital due to their limited financial resources, and to limit their time off work. Beliefs about consequences were also linked to the participant's intention (*Motivation and goals*). Participants were more motivated to ask catheter-related questions if they experienced problems (see next section motivation and goals for the relevant quote).

"For self-satisfaction, you need to ask the question. I feel compelled to ask because of my own inquisition. I've got to satisfy myself. It's very important that a patient does inquire about their progress and find out what's happening….I think it is important to ask questions. It shows the staff that you are interested in your care and you get knowledge from it" (P03).

"So I really want to ask questions, whatever speeds my recovery and discharge. There's no doubt about that. For how much I want to ask, I think it just depends on personal preference and circumstances, because I had every intention of coming here to have my surgery done and I knew what I needed to do to get out. Financially, I needed to be in and out within five days due to my work situation. I only have limited time off work and my cats are costing me money in the cattery, it was financially going to have to be that way. So I knew what I wanted to ask to get the catheter out and get out of here quicker" (P06).

Motivation and goals

In terms of specific catheter-related questions, participants intended to ask about the removal (certainty of intention) only if they encountered problems while the catheter was in-situ, e.g. pain, discomfort or infection, otherwise they were less likely to ask questions for its removal.

"When I first got the catheter put in, it was okay. Then it started to become uncomfortable and painful. At that point, I had to ask someone to get it taken out. Otherwise, I mightn't have bothered to ask about it coming out" (P07).

Social influence

Social support from family helped participants to ask general questions. Participants reported that their family often advocated on their behalf if they were unable to ask questions themselves (*Beliefs about capabilities*).

"I don't know why I couldn't, it was quite a thing for me, for to not be shy and ask these questions…My family helped me out by getting answers on my behalf" (P11).

"If I didn't ask something my wife would go and ask to get the answer" (P08).

5.5 Discussion

5.5.1 Key findings

Results from this TDF-based interview study identified a range of barriers and enablers to patient engagement with HCPs in general and specifically regarding their catheter removal. The most commonly reported barriers and facilitators are in the areas of knowledge, beliefs, experiences, motivation and the surrounding environment. Responses attributed to the *Nature of the behaviour* domain suggest that patients do not routinely engage with HCPs regarding their catheter removal, but many do engage with HCPs more broadly about other aspects of their care, suggesting the opportunity for greater engagement in catheter removal is possible, at least in principle. Nine domains highlighted the remainder of the barriers: *Knowledge, Social/professional role and identity, Beliefs about capabilities, Beliefs about consequences, Motivation and goals, Environmental context and resources, Social influences* and *Behaviour regulation*. Four domains identified enablers: *Skills, Motivation and goals, Beliefs about consequences*, and *Social influence*. The *Beliefs about consequences* and *Social influences* domains identified barriers as well as enablers.

5.5.2 Strengths and limitations

This is the first interview study to explore barriers and enablers to patient engagement in the context of urinary catheter removal using the theoretical domains framework (Michie *et al.*, 2005). The identified barriers fill a gap in the literature to better understand patient-related behaviours to prompt catheter removal practices and contribute to understanding barriers/enablers to engaging patients in their care more broadly. The interviews were designed using the TDF which provided broad theoretical coverage to explore behavioural determinants that can be linked to theory/theories for developing theory-based interventions (Rothman, 2004). Diversity in catheter indications provided a richer data set and suggests generalisability of results in terms of participants' experiences, in comparison to interviewing participants with the same catheter indications. This adds to a cumulative knowledge base and theory building about catheter removal behaviours. In the next steps, the identified behavioural determinants (modifiable barriers) can be mapped on to specific behaviour change techniques (BCTs) to develop a behaviour change intervention (Michie *et al.*, 2008) representing a complete systematic process to change behaviour in the field of implementation research.

Efforts to maintain rigour were carried out at multiple stages of the study as follows:

1) Criteria-based sampling to include a wide range of viewpoints and reduce potential selection bias (Barbour, 2001)
2) Double coding by two separate coders to improve the degree of concordance and refinement of codes (Franklin and Ballan, 2001)
3) Involvement and representation from PPI panel members to improve the quality of research (INVOLVE, 2013) at a) the study design stage for development and piloting of the interview schedule and b) the data analysis stage to cross-check the interim findings for refinement and accurate interpretation of participants' accounts (Barbour, 2001).

Although the identified barriers are related to the catheterised patients in the hospital setting (discussed in detail in the next section), nevertheless, it could be argued that these results would bear some commonalities to patient engagement in general and patients with short-term catheters in the community setting also. However, despite the commonalities, these findings should be carefully considered bearing in mind differences in the secondary and community care setting, differences in the allocation of resources (Hooton *et al.*, 2010) and patient interaction with community staff which is often on a one-to-one basis in patient's own home environment.

5.5.3 Findings in relation to previous studies

Knowledge

A narrative review of the evidence shows that a patient's knowledge is an important element, which affects their participation, to enhance safety (Longtin *et al.*, 2010). This review also echoes the findings reported in this chapter showing a likely relationship between a patient's lack of knowledge and engagement in terms of acceptance of the new patient role and a lack of awareness of the need, purpose and functionality, associated risks, comorbidities, and pre-conceived misconceptions about the treatments received (Longtin *et al.*, 2010).

The findings of a study using mixed qualitative methods (ethnographic observations and interviews) with patients and HCPs, demonstrated that the topic of patient safety covering possible risks is not a key focus in communication between patients and their HCPs (Martin *et*

al., 2013). This study also suggests that limited knowledge of risks and safety about care is one of the barriers to affect patient engagement and patient safety (Martin *et al.*, 2013).

Knowledge is one of the fundamental determinants in the information, motivation, and behavioural skills (IMB) model for risk-reduction and an important element to focus on in behaviour change intervention strategies (Chang *et al.*, 2014). In the study reported in this chapter, the lack of knowledge about catheter-associated risks affected participant's beliefs about the consequences of prolonged catheter duration. In addition, *Knowledge* also intersected with *Environmental context and resources*. The participants believed that the lack of explanation by staff was due to time constraints which resulted in the relay of none or partial information on catheters. This finding is supported by Presseau *et al*., who suggested multiple goals and time constraints can affect a physician's performance (2009). This highlights possible flaws in HCPs' consent process and suggests a need for improvement to ensure adequate information provision for greater patient involvement in catheter removal decisions (Bhardwaj *et al.*, 2012).

Social/professional role and identity

Although the patient's role in facilitating prompt catheter removal has not been explored previously, patient engagement in general has been internationally recognised as a key factor in improving the care quality, delivery, and safety of health services (Barello *et al.*, 2012). The patient's role has also been explored in specific contexts such as radiotherapy, which demonstrated that together with support and encouragement from HCPs, patients can be actively engaged in their own care in a mutually empowered and supportive way (Mullaney *et al.*, 2014).

In contrast to Mullaney *et al.*'s findings, the study reported in this chapter showed that participants felt restricted within the boundaries of their role as a patient and did not want to question the professional capabilities of HCPs. Perhaps the reasons for this were indeed a lack of empowerment, support and encouragement from HCPs which affected participants' capability to engage and ask questions (*Beliefs about capabilities*). This finding was consistent and cross verified with the findings of the parallel HCP interview study (Chapter four) where some of the HCP participants expressed the receipt of prompts from patients with mixed feelings and others felt challenged by this. Although this finding differs from some previous

studies (Blackstone *et al.*, 2015; Barello *et al.*, 2012; Mullaney *et al.*, 2014), it is consistent with a study conducted by the UK National Patient Safety Agency (Pittet *et al.*, 2011). This study involved face-to-face interviews with patients admitted to medical and surgical wards on healthcare-acquired infections. Similar to the results of the study reported in this chapter, 20% of the 222 patients in the study did not want to question the ability of their HCPs. This may have been because differences between patient and HCP perspectives have been reported to cause negative feelings, tension and mistrust in the patient-provider relationship (Hrisos and Thomson, 2013; Martin *et al.*, 2013).

Another study reported the patient's role to be one of the related factors that affect the patient's capability and willingness to participate in the health care process (Longtin *et al.*, 2010). Explaining the risks to patients of delayed catheter removal may empower them sufficiently to overcome this concern. This may be particularly the case for family members and carers who can become extremely motivated to advocate for patients when comes to safety. In addition, patient participation and engagement was reported to be influenced by healthcare worker related factors, such as the desire to maintain control, lack of time, personal beliefs, type of illness, and training in patient-caregiver relationships (Longtin *et al.*, 2010).

Participants' preferences about the hierarchy among HCP professional roles for catheter removal decision making was fairly evident. The participants described their preference to ask the medical staff or senior nursing staff (ward manager) about their catheter removal. But the most frequent contact they had was with the nurse. This inefficient communication behaviour, as perceived by the patients, might have contributed to additional delays in initiating the catheter removal process (Parker and Coiera, 2000). The participants expressed a preference to speak to doctors/senior HCPs over more junior HCPs which indicates that the hierarchy in the healthcare professional structure is maintained to some extent by the patients themselves. In preferring to engage with senior HCPs, and making assumptions about the competencies of more junior staff, patients are exacerbating pre-existing hierarchical structures amongst HCPs as identified by Foronda *et al.* (2016).

Beliefs about capability

Participants' ability and confidence to ask about catheter removal was partially dependent on their ability to manage without a catheter (self-efficacy). A systematic review (Schwappach, 2010) on collective evidence of patients' engagement views in error prevention and enhancing patient safety reported that patients shared a positive views about engaging in their safety in general but showed considerable variation in their intention to engage and the actual behaviour. This review examined studies that applied the Theory of Planned Behaviour and indicated an important role of self-efficacy in engagement in preventing incidents and errors.

The variability in study participants' self-efficacy (perceived ability to engage about catheter removal) was affected by pain in the postoperative period and mobility factors. These factors have been previously linked to each other with regards to how quickly a patient recovers from initial postoperative pain and their ability to manage without a catheter. These factors depend upon the type of surgery a patient has undergone in relation to how far the toilet is located from the patient's bed space (Bhardwaj *et al.*, 2012). The study participants' self-efficacy was also affected in the context of 'to whom and when' they asked, interpersonal skills, and rapport with staff which collectively intersected across the domains of *Behaviour regulation* and *Social influence*.

Beliefs about consequences

One of the factors related to inadequate engagement with catheter removal was a participant's lack of understanding about the risks of prolonged catheter duration (interlinked with lack of knowledge), which affected the participant's beliefs about consequences (outcome expectancies). Lack of knowledge and low health literacy have been linked to poorer health outcomes (Berkman *et al.*, 2011). Misconceived ideas such as, 'the catheter was curing their illness' induced misleading beliefs for participants to be in favour of keeping the catheter in for longer.

Prolonged use and overuse of catheters has been associated with greater convenience for both patients and nurses (Apisarnthanarak *et al.*, 2007; Krein *et al.*, 2013; Fakih *et al.*, 2008; Bhardwaj *et al.*, 2012). This was found to be the case for some of the study participants, whereby the convenience of having a catheter after surgery prolonged their catheter

duration. In contrast, other study participants found catheters to cause hindrance, restrict mobility and act as a contributory factor to prolonging their hospital discharge. In the parallel HCP study, some nurses debated that prolonging catheter duration enhanced patient safety by preventing patients with reduced mobility from falling. However, this observation has been criticised by Lo and colleagues (2014) who advocate the implementation of falls prevention strategies rather than leaving the catheter in-situ for longer putting patient safety at risk in developing CAUTIs (Lo *et al.*, 2014). These misconceptions warrant to be targeted in interventions to improve the speed of catheter removal.

Motivation and goals

Engaging with HCPs concerning general matters was important to the study participants and was influenced by the desire to achieve self-satisfaction, to show interest in their own care and to speed up the discharge process. However, in general, participants were not motivated to engage HCPs about their catheter removal because they perceived catheter removal as primarily a role of HCPs (*Social/professional role and identity*) requiring minimal input from their end. Patient-provider interactions (or lack of) affect patient motivation and outcomes (Greenfield *et al.*, 1985). As described by Maclean *et al.*, the patient's level of motivation can be influenced by their beliefs, experiences, and the surrounding environment (2000). The study participants only became motivated to ask for removal if they experienced any problems or pain from the catheter. Participants' lack of knowledge about the risks of prolonged duration and inability to manage without a catheter due to reduced mobility and post-operative pain also resulted in a low level of motivation to engage (Bhardwaj *et al.*, 2012; Pickard *et al.*, 2012b). Once participants were made aware of the possible side-effects of prolonged catheter duration, they expressed that they would be more motivated to engage with HCPs to speed up their catheter removal. Although these beliefs were expressed in a hypothetical scenario, it indicates the participants' willingness and motivation to engage in their catheter removal process.

Environmental context and resources

Participants highlighted a number of barriers in the context of the environment and resources. Issues within a participant's environment, such as a lack of accessible and conveniently located toilets in the vicinity, discouraged participants from engaging with their catheter removal. The issues of toilet location in terms of the surrounding environment and availability of resources

had a considerable impact on patients with reduced mobility and those recovering from a surgical procedure. This is in agreement with previously reported studies (Krein *et al.*, 2013; Bhardwaj *et al.*, 2012).

To promote early catheter removal, the use of alternative methods (e.g. a commode, bedpan, or urinal bottle) at the bedside was not universally embraced by participants due to a lack of privacy in a shared bay with five other patients. Perhaps newer hospital designs incorporating the provision of en-suite facilities may encourage early catheter removal and the use of alternative toileting methods. However, this has financial and resource implications and is unlikely to apply to the majority of patients in the existing UK NHS, at least not in the short to medium term. The participants who would have considered using an alternative method over a catheter were over 65 years of age and they were not presented with a choice by their HCPs. Existing literature emphasises the use of alternative toileting methods in strategies to prevent CAUTIs by facilitating early catheter removal (Meddings *et al.*, 2014; Lo *et al.*, 2008) but this clearly requires a change in HCPs' current practice. The consent process undertaken by HCPs should explicitly discuss the need for, and subsequent risks of, indwelling urinary catheters. This should include a discussion on the use of alternative methods to reduce catheter duration and the patient's role in reminding staff about catheter removal, offering 'permission' to provide prompts to HCPs. These could be key ways to change current practice and increase engagement (Krein *et al.*, 2013).

In terms of resources issues, limited availability and a shortage of staff leading to time constraints were perceived as a barrier to engagement by the participants. This finding validates previous research in which staff time constraints have been reported as one of the major barriers to engagement (James, 2013). Participants were reluctant to use the nurse-call bell to ask questions due to not wanting to interrupt busy staff perceived to be dealing with other competing demands (Tzeng, 2010). The attitudes of HCPs and other patients in the vicinity towards using the nurse-call system discouraged participants to ask questions or call for help when it was needed. As highlighted by Lasiter (2014), nursing staff should be more receptive and made aware of the importance for patients to use the call system to encourage patient-initiated interactions (Lasiter, 2014) which may help increase patient engagement as vigilant partners in safety (Schwappach, 2010). As a solution to the call bell problem, nurses could be more explicit in offering mutually acceptable ways by giving 'license' to patients to

use the bell more freely to encourage patient engagement; rather than patients feeling that they are summoning HCPs, which may cause unintended negative consequences to the patient-HCP relationship. This could also alleviate power and control embedded issues within the patient-caregiver communication (Deitrick *et al.*, 2006).

Social influence

Participants viewed the support of others as important to engage with HCPs. Of particular importance were attitude and social pressure from HCPs and other patients. Social support from the family could also encourage or discourage a patient's intentions and capability to engage. This is consistent with existing evidence on the role of social support as a resource and its high potential in the prediction of behaviour (Schwarzer and Leppin, 1991). Social support has also been linked with an individual's self-efficacy (Schwarzer and Fuchs, 1996) whilst the influence of the social environment, including support from others, has been shown to affect health behaviours and morbidity (Cohen, 1988).

In the study reported in this chapter, although some participants found it easier to engage with staff who had a polite manner and with whom they had a good rapport, the staff with an impolite or rude manner discouraged participants to engage and caused a delay in asking questions until they found another HCP with whom they felt comfortable (Hrisos and Thomson, 2013). As reported by study participants, staff attitudes could be a hindrance to patients wanting to ask challenging questions about their catheter removal since patients feared jeopardising their relationship with the staff members. This finding validates those of Hrisos *et al.* (2013). In support of this argument, a study participant found it easier to ask questions to a member of staff who they did not like; perhaps they felt it easier to challenge someone who they did not worry about upsetting (self-developed strategy). Participants developed these strategies to help ask questions themselves or sometimes via their family members. As predicted by Schwarzer, social support from the family, who acted on the patient's behalf to ask questions, also confirmed the link between a patient's capability (self-efficacy) and social support (Schwarzer and Leppin, 1991) which at times was contingent on participants being in pain or otherwise uncomfortable.

To implement evidence-based guidance, constraints on HCP time due to competing demands is a frequently identified barrier (Cabana *et al.*, 1999; Francke *et al.*, 2008). Competing

demands interlinked with work overload due to a lack of staff resources (described above). Perceived competing demands of staff created social pressure for participants as they did not want to interrupt staff to ask questions when busy doing other 'more important' tasks (as perceived by the participants), thus, discouraging participants from engaging at certain times. This finding was endorsed by the parallel HCP interview study (Chapter four) in which participants confirmed that catheter removal was low on their priority list over other tasks such as medication rounds, dressing wounds and doing multidisciplinary rounds. This finding was well supported by a study of 200 clinicians (nurses and doctors) in which HCPs reported to manage their competing demands through strategies such as task-switching, multitasking and prioritising certain types of tasks over others (Walter *et al.*, 2014; Presseau *et al.*, 2009).

Furthermore, participant engagement behaviour was affected by the hierarchical structure amongst HCPs associated with making the catheter removal decision. Participants described being aware of nurses' inability to make the catheter removal decision, thus, preferred to ask the doctors to get a speedy answer. This finding adds to the literature confirming structurally empowering work conditions has not only an effect on professional practise environment and patient care quality (Laschinger, 2008) but also on patient's preferences related to engagement.

Emotion

The study participants expressed a range of negative emotions related to prolonged catheter duration and associated infections, denoting anticipated regret in a hypothetical context. As described in a systematic review (Wilson *et al.*, 2017), emotion is a complex reaction pattern which affects the decision-making process for not only the patients but for the HCPs also. In the parallel HCP study (chapter four), the participants also described that emotion affected their decision-making process around catheter removal behaviour. The negative emotions cross-linked with a participant's lack of knowledge (*Knowledge*) about the risks of prolonged catheter duration generating anticipated regret about the catheter infection and the *Social/professional role* and *identity* where participants did not want to prompt HCPs for fear of generating tension and mistrust in the patient-provider relationship (Hrisos and Thomson, 2013; Martin *et al.*, 2013). This affected participants' willingness and decision to take part in their own care to improve their safety (Longtin *et al.*, 2010).

This finding echoes the results of a meta-synthesis that reported similar adverse emotional responses by female patients, such as anxiety and feelings of upset when they did not meet their weight loss target, to have a negative impact on the relationship with their HCP (Heslehurst *et al.*, 2014). Anticipated regret should perhaps be considered as one of the elements in shared decision-making strategies (Speck *et al.*, 2016) which can be employed in routine care by increasing patients' awareness and engagement by means of employing appropriate decision aids such as written information leaflets, videos or interactive electronic presentations (Coulter and Ellins, 2007; Barry and Edgman-Levitan, 2012).

Behaviour regulation

This qualitative study with patients suggests that participants did not routinely engage with HCPs related to their catheter removal. A few asked questions related to catheter removal only when compelled due to having problems or experiencing pain from the catheter. Participants regulated their engagement behaviour (asking general questions) in the context of 'to whom' they asked and 'when' they asked (Coulter, 2012) in relation to staff members' manner and their competing demands (*Social influences*). As discussed in the environmental context above; a participant's age and a lack of alternative options (e.g. a bedpan or commode) offered by staff further delayed catheter removal. To promote patient engagement, strategies to prevent CAUTIs by early catheter removal should include the use of alternative toileting methods (Meddings *et al.*, 2014; Lo *et al.*, 2008; Schwappach, 2010). Alternative toileting methods should be considered for bladder emptying before the insertion of a catheter, which facilitates limiting the use and avoiding catheter use in the first instance (Saint *et al.*, 2000). Alternative methods produce a lower incidence of bacteriuria and result in fewer complications (Warren, 1997). In instances where using an alternative method is not appropriate, such as bladder emptying in patients with neurogenic impairment, suprapubic and intermittent catheterisation should be considered which cause fewer complications over urinary catheters (Nicolle, 2012). All patients should be offered alternative toileting methods as a choice if they are able and willing to use them, which was not readily the case with the study participants.

Nature of the behaviour

The study reported in this chapter confirmed that it is not routine practice for patients to engage with HCPs regarding their catheter removal. However, they do engage with HCPs by asking general questions. With support and encouragement from HCPs, perhaps patients' ability to engage in general issues can be utilised to prime them to engage in catheter removal behaviour also, as demonstrated in the *ThinkSAFE*™ project (Wright *et al.*, 2016). Chapter nine of the *ThinkSAFE*™ project report involved the development and evaluation of an intervention to support patients to directly engage with health-care staff to enhance their safety and ask staff questions if they had any concerns. In terms of 'who needs to do what differently', during the consent process HCPs needs to adopt a detailed approach by explicitly discussing the risks of indwelling urinary catheters; discussing the use of alternative toileting methods to reduce catheter duration; support and encourage patients to engage in the catheter removal process; and provide explicit guidance on what to do, why, when, and how to communicate their reminders to staff. This approach has the potential to circumnavigate the roles and boundaries and break current habits that contribute to a lack of engagement and cause a delay in prompt catheter removal (Potthoff *et al.*, 2018; Krein *et al.*, 2013).

5.6 Conclusion

This study identified a number of barriers to patient engagement in prompt catheter removal. To enhance patient engagement in the current context requires a robust intervention designed to change the collective behaviour of both patients and HCPs with emphasis on greater patient engagement in the catheter removal process. This could have the potential to leverage an under-utilised approach to preventing catheter-related infections and enhance patients' catheter-related safety while in hospital. The key aspect to enhancing patient engagement is to create an environment for patients that would enable and encourage them to take part in their care to improve catheter safety. For HCPs, this could be possible through encouraging them to work collaboratively with patients on the engagement aspect, so that patients feel supported to ask about their catheter removal without feeling threatened about jeopardising their relationship with clinical staff. In addition, collaboration with patients could help HCPs working conditions that enable learning and action with regard to patient engagement without being criticised and challenging their professionalism. The success of an intervention is dependent on the identification of relevant stakeholders' perspectives and

following a systematic approach to the intervention design process. Moving forward, identified barriers from this qualitative study can be mapped onto behaviour change techniques in the development of a behaviour change intervention. Furthermore, an appropriate mode of delivery in terms of the APEASE criteria (affordability, practicability, effectiveness/cost-effectiveness, acceptability, side-effects/safety and equity) needs to be identified (Michie *et al.*, 2014).

The barriers identified in this study are collective compounding factors which instigate a delay in the catheter removal process and are likely to be accountable for resultant CAUTIs. While patients see catheter removal as the role of HCP, there is potential for patients to get involved in initiating the catheter removal process. Concurrently, HCPs need to adapt their practice to ensure that they undertake detailed informed consent to make patients aware of the risks of prolonged catheter duration and the use of alternative toileting methods whilst supporting patients to take part in their catheter removal process. A collective, two-way shared approach to future interventions, designed with behaviour change strategies, is required to change existing habits and bring about change in current practice to enhance patient safety and provide better patient outcomes.

Chapter 6. General discussion

6.1 Chapter overview

This chapter provides an overarching discussion of the key findings from this thesis across all of the studies, including a reflection on the existing interventions identified, a summary of the main results in relation to the research objectives and existing interventions and, core findings in the context of local healthcare pathways. The chapter closes with a discussion of the strengths and limitations of the approach used to build the body of research presented in this thesis. Subsequently, overarching implications and the impact of empirical findings for policy and practice are explored. Finally, opportunities and possible steps for developing a future intervention are discussed.

6.2 Summary of key findings

This research aimed to develop an improved understanding of the existing literature and identify barriers and enablers to the prompt removal of short-term urinary catheters in a secondary care setting from the perspectives of patients and healthcare professionals (HCPs). This aim was met by conducting three main studies. Study 1 (chapter 3) consisted of a comprehensive review of the literature for evidence on catheter associated urinary tract infections (CAUTIs) and related interventions, plus the review of the local, national, and international guidance documents on catheter removal. Study 2 (chapter 4) consisted of a Theoretical Domains Framework (TDF) based interview study with HCPs to identify behaviour related barriers and enablers to prompt catheter removal. Study 3 (chapter 5) consisted of a TDF-based interview study with patients to identify behaviour-related barriers and enablers to prompt catheter removal.

6.2.1 Study one: literature review (chapter three)

Objective: Review the CAUTI literature for evidence of existing interventions to reduce CAUTIs and review the local, national, and international guidance documents on catheter removal.

In chapter three, I summarised the literature on urinary catheters in terms of aetiology, the impact and burden of CAUTIs on patients and the NHS including antimicrobial resistance, and existing national and international initiatives for the prevention (i.e. limiting the use of urinary catheters or early removal) and management of CAUTIs. This chapter described the state of

the literature, reflecting on current interventions with respect to their relative success or failure to promote CAUTI recommendations and reduce CAUTIs, and consider how a theory-informed approach to intervention design could be useful to better promote prompt catheter removal in practice. A summary discussion of existing interventions has been provided below.

Summary discussion of existing interventions

In the current literature, a range of interventions have been implemented in clinical practice to reduce *E.Coli* rates and symptomatic CAUTIs. Existing interventions focus on either limiting the initial use (Murphy *et al.*, 2014), or early removal of indwelling urinary catheters (Meddings *et al.*, 2010) to reduce the formation of bacterial biofilms, bacteriuria and bladder colonisation that are responsible for the development of CAUTIs (Nicolle, 2014). As per a systematic review and meta-analysis on reminder interventions, four key steps (described in chapter three) are involved in the life cycle of a urinary catheter before it can be removed (Meddings *et al.*, 2010): 1) the physician is aware of the presence of a urinary catheter, 2) the physician recognises that the catheter is no longer required, 3) the physician writes the removal order, and 4) a nurse acts on the physician's order and removes the catheter. However, since this review was published (Meddings *et al.*, 2010), nurse-led protocols have been implemented which bypass some of these steps in an attempt to accelerate the catheter removal process. In addition to the nurse-led removal protocols, the focus of existing interventions has been on education and training, making adaptations to staffing levels, and individual or multi-faceted bundle interventions incorporating a combination of stop orders and criteria-based reminders to simplify the catheter removal process. Most of the studies have been targeted at HCPs except for a small exploratory study on patients' perspectives on the timing of catheter removal (Bhardwaj *et al.*, 2012) and another study that combined nurse-led protocols with educating patients and their families, via information flyers, to reduce CAUTIs (Oman *et al.*, 2012). Overall, the literature review confirmed that none of the studies conducted a detailed investigation into patient and HCP related barriers and enablers to prompt catheter removal or used a theory-based approach to design targeted interventions. A discussion of identified interventions from the literature review is provided below.

In summary, one of the most effective interventions reported in the literature appears to be educational interventions combined with feedback on the impact and burden of CAUTIs, catheter removal protocols such as HOUDINI, and reminder systems. For system-level

interventions, there is some evidence that increased nurse staffing levels reduce catheter duration and associated CAUTIs. Patient and family education through one-to-one sessions and information flyers to raise awareness on catheter infections have been reported to show potential and have been suggested to be worthy of further evaluation. However, the exact impact of patient and family education on reducing CAUTI rates or reducing catheter duration is not clear. Also, there were no intervention studies identified in the literature that focused on the patient's involvement in providing verbal or written prompts/reminders (environmental level) to their HCPs to reduce catheter duration. From the current literature, it is not clear what barriers and enablers are addressed by existing interventions which makes it difficult to apply and generalise findings. Theory-based approaches help to bring coherence and clarity on what barriers and enablers exist and what strategies are best suited to address those barriers in that setting, making the case for work conducted in study two and three.

6.2.2 Study two: healthcare professional interviews (chapter four)

The objectives of this study were to establish current practices around catheter removal and identify HCP behaviour related enablers and barriers to prompt catheter removal. Chapter four describes a TDF-based interview study with ward-based HCPs (nurses, doctors and healthcare assistants) involved in all aspects of short-term urinary catheters i.e. catheter insertion, catheter removal assessments, decision making, and removal of the catheter. The interview guide was designed to address key domains from the TDF, focusing on identifying barriers and enablers to prompt catheter removal based on HCPs' experiences.

Summary of the key findings- HCPs study

Current practice and variations in guidance on recommended behaviours concerning catheter removal were identified within the TDF domain *Nature of the behaviour*. Variations in practice revealed catheter removal times that vary between wards; some wards removed catheters at midnight and others at 6 am the next morning. This practice does not appear to be evidence-based and is not concordant to the current guidance. As per the guidance (Loveday *et al.*, 2014), catheters should be removed immediately when there are no clinical indications for their continued use.

The barriers were identified within nine domains: *Knowledge* (there was poor knowledge of guidance and evidence-based practice including microbiology of CAUTIs); *Social/professional role and identity* (the hierarchy around decision-making process); *Beliefs about capabilities* (the inability to make a catheter removal decision (oneself) and patients' inability to manage without a catheter (others)); *Beliefs about consequences* (issues of convenience, patient dependence on a catheter, the impact of CAUTIs); *Motivation and goals* (low motivation to remove due to competing demands); *Memory attention*, *and decision processes* (forgetfulness, perceived low priority for catheter removal); *Environmental context and resources* (location and availability of toilets and staff assistance); *Social influences* (staff attitudes, ward culture); and *Emotion* (indifferent and negative feelings related to prolonged catheter removal).

The enablers could be characterised within five domains: *Skills* (HCPs were highly skilled at removing catheters); *Behaviour regulation* (HCPs used daily task lists and hand over notes as reminders); *Emotion* (HCPs described job satisfaction and generation of positive feelings with timely catheter removal); and *Social influences* (HCPs viewed senior and specialist colleagues as role models).

6.2.3 Study three: patient interviews (chapter five)

The objectives of this study were: to establish if patients routinely engaged with their HCPs regarding their catheter removal, identify enablers to patient engagement, and identify barriers to patient engagement. Chapter five described a TDF-based interview study with hospitalised patients who had a short-term catheter inserted during their hospital admission. The methods for the interview design and analysis were identical to the HCP interview study (chapter four).

Summary of the key findings- patient study

The statements coded under the *Nature of the behaviour* domain established that patients do not routinely engage with their HCPs for catheter removal. However, they reported that they engage with their HCPs in general matters regarding activities of daily living. When patients asked questions to HCPs, it was important to them 'to whom' they asked (social influences),

'when' they asked (behaviour regulation), and avoidance of busy times for HCPs such as during ward rounds or medication rounds (competing demands- social influences).

The barriers were identified under nine domains: *Social/professional role and identity* (boundaries of the patient's role in asking staff questions about catheter removal and patients' perceptions of catheter removal primarily being staff members' responsibility); *Knowledge* (patients' lack of knowledge about catheter risks and functionality leading to misconceptions and a lack of engagement with HCPs for its removal); *Beliefs about capabilities* (a lack of confidence to engage with HCPs regarding catheter removal especially if physically dependent on staff for assistance); *Beliefs about consequences* (the catheter to become an object of convenience for both patient and staff); *Memory*, *attention and decision processes* (the patient's decision to delay or not engage was affected by staff members' manner and their competing demands); *Environmental context and resources* (inaccessibility and lack of toilets in the vicinity, especially in relation to a patient's reduced mobility); *Social influence* (staff attitudes and views, their competing demands, and hierarchy around catheter removal decisions); *Behaviour regulation* (patients regulated their engagement behaviour by selecting 'when' they asked avoiding busy times for HCPs); and *Emotion* (expression of negative feelings and anticipated regret if suffered from a catheter infection as a result of non-engagement).

Key enablers to engaging more broadly about other aspects of care were identified under four domains: *Skills* (patients had the ability to engage, facilitated by having a good rapport and interpersonal skills with staff which enabled more effective engagement); *Beliefs about consequences* (engaging with staff helped patients to achieve self-satisfaction, show interest in their care, and speed up the discharge process); *Motivation and goals* (patients had high motivation to ask about catheter removal if they encountered problems with their catheter); and finally *Social influence* (support from family helped and encouraged patients to engage with HCPs).

6.3 Overall discussion of identified barriers in relation to existing interventions and guidelines

6.3.1 Knowledge gaps and education/training interventions

Knowledge gaps for HCP

The current research identified that HCPs were highly skilled in removing catheters but lacked specific microbiology knowledge concerning the accumulative risk of developing bacteriuria which increases with each day of catheterisation (Gokula *et al.*, 2004; Fukuoka *et al.*, 2018). The education and training interventions summarised earlier in this chapter and the literature review in chapter three focused on catheter insertion technique and its maintenance but did not identify or address this knowledge gap (Jones *et al.*, 2018; Justus *et al.*, 2016; Gordon, 2015; Sundaram *et al.*, 2012). Audit and feedback interventions have shown some promise in reducing CAUTIs but did not include information to address the knowledge gap (Justus *et al.*, 2016). An audit and feedback strategy coupled with addressing the gap in HCPs' knowledge on microbiology evidence (1 day of a catheter in situ equating to a 5% increased risk of developing bacteriuria) may prove more effective in changing HCPs' behaviour to promptly remove catheters.

Knowledge gaps for patients

These are another areas for potential pathway change. The patient study identified gaps with missed opportunities and inadequate provision of information from HCPs to patients on the purpose, functioning, and side effects of urinary catheters. The lack of information led patients to have misconceived ideas about catheters, for example 'a catheter is a curing device' and 'a catheter is always necessary when hospitalised', which is not the case at all times. The provision of inadequate information and poor communication during the consent process was highlighted to be due to HCPs' time constraints. HCPs should signpost and provide high-quality information to patients not only during the consent process but throughout their hospital stay. This could help to break information down into more manageable amounts rather than being provided in one session during the consent process which may be overwhelming to the patient; this could simultaneously overcome the time constraint barrier for HCPs. Providing catheter-related information at multiple time-points will create opportunities for further safeguarding of patients and support them to gain a better understanding of the catheter's

functionality and removal as soon as it has served its purpose. Adequately informed patients should have information on the catheterisation process, expected duration, side-effects of prolonged duration, and use of alternative methods to encourage the prompt removal of catheters. Inadequately informed patients are less likely to ask questions about their catheter removal (Coulter, 2012). This barrier can be addressed by informing/educating patients and families in a two-way process. Firstly, by means of providing information flyers as recommended (Bhardwaj *et al.*, 2012) and trialled in previous studies (Oman *et al.*, 2012). Secondly, by addressing the deficiencies in HCPs' practices to improve the information pathway and encourage patients to prompt HCPs on a daily basis for timely removal during the catheter consent process.

The Patient Information Forum has developed a seven-step approach to embedding high-quality and accessible information for patients incorporated across all care pathways (Patient Information Forum, 2018). This aims to help address health inequalities and empower patients to make more shared-decisions and informed choices about their treatment and care. The seven steps are as follows: 1) get organisation leadership team on board, 2) identify patients' perspectives, 3) identify healthcare professionals' perspectives, 4) map current patient information pathways and identify gaps, 5) address gaps to make improvements, 6) evaluate the impact of changes, and 7) regularly review and maintain patient involvement in the implementation of change. Study three in this doctoral project explored the patient information pathway concerning catheter care and addressed the second and the fourth steps; study two addressed the third step to identify the gaps in catheter information provision from the perspective of HCPs. Future work should explore steps five, six and seven with further work on the verification of other steps.

The missed opportunities in routine care for information provision to patients by HCPs during the consent process, as well as while a catheter is in-situ, that have been identified in this thesis can be addressed to improve the quality of care. Nevertheless, the issue of a lack of engagement in the catheter removal process extends beyond patients' information/knowledge and into social influence and beliefs about capabilities. Patients and family members need to be supported to ask questions that enable them to actively engage in their care.

The ThinkSAFE project (Wright *et al.*, 2016) provides an example of this concept in action, in which, the intervention supports patients to directly engage with their HCPs to reduce harm, enhance their safety, and protect them against unintended harm while in hospital. The ThinkSAFE intervention was developed to support collaborative interactions between patients, in addition to addressing barriers to asking questions, being asked questions, and of raising and being receptive to patient concerns raised about safety. It is a core premise of ThinkSAFE that both patients and HCPs need support simultaneously if such safety interactions are to take place without any negative consequences (Wright *et al.*, 2016).

A similar approach to ThinkSAFE could be useful in the context of urinary catheters. This could help overcome the patient barrier of belief that initiating and deciding catheter removal is the sole responsibility of HCPs which has the potential for shared responsibility (*social /professional role and identity*). It would assist patients in making shared decisions and fostering patient involvement in their treatment and care. Patient vignettes, visual aids or checklists can be used as potential approaches to the intervention design to encourage patients to engage with their HCPs for prompt removal of their catheter (Schwappach *et al.*, 2013; Yatim *et al.*, 2016; Wright *et al.*, 2016).

6.3.2 Adaptation and changes to the low staffing levels

In both empirical studies (HCP and patient), low levels of nursing staff (*environmental context and resources*) were reported to be linked to staff members' increased individual work overload, competing demands, and the belief that the catheter was a device of convenience. Two studies have previously addressed this issue via an exploration of increased nursing hours per patient-day with the input of continence nurses as the intervention (Twigg *et al.*, 2011; Westra *et al.*, 2013). Findings from these studies reported a significant reduction in UTI. However, to implement the same approach on each of the wards in a large secondary care hospital would have considerable resource implications. A more sustainable and cost-effective way around addressing this issue might be to form a small dedicated 'catheter removal/safety team' consisting of a registered nurse trained in conducting catheter removal assessments and performing catheter removal procedures, with the help of nursing healthcare assistants who can assist patients with toileting needs afterwards. This team would be able to help the regular ward staff's high work-load due to a low staffing level and prevent catheters from becoming a 'device of convenience' which results in prolonged and overuse of

catheters (Apisarnthanarak *et al.*, 2007; Krein *et al.*, 2013; Fakih *et al.*, 2008; Bhardwaj *et al.*, 2012). With a view to maximising efficiency, rather than being based on one ward, this team could cover multiple wards in each clinical speciality to assess and remove patients' catheters on a daily basis. The team set-up could even be integrated within the antimicrobial stewardship teams specifically assembled for optimising antibiotic use and minimising patient adverse events for developing resistance to antimicrobial agents (Huang *et al.*, 2013; Pollack and Srinivasan, 2014).

6.3.3 Environmental barriers and use of alternative methods to catheterisation

The main environmental barriers reported by both HCP and patient participants related to the ward layout and accessibility in addition to the availability and distance from the patient's bedside to the nearest toilet. This was particularly important to patients (elderly and surgical patients) and nursing staff during the initial post-operative recovery period (24-48 hours) when patients had reduced mobility and were depended on staff for assistance with toileting needs, hence, the perceived convenience of leaving a catheter in-situ for longer.

The lack of accessible and ample toilets is a systems-level barrier which is more difficult to modify in the first instance, as it requires considerable resources to provide patients with individual en-suite toilets (Bhardwaj *et al.*, 2012). An alternative to this could be the use of alternative methods to having a catheter in-situ such as a commode chair (a toilet on wheels), bedpan or disposable urinal bottles (Meddings *et al.*, 2014; Lo *et al.*, 2008). However, some of the participants in the patient study considered the use of alternative methods to be less practical when in the immediate postoperative period due to pain or discomfort. Others expressed that it was not a dignified affair when there were five other patients in the shared ward/room (bay) with them, while other participants expressed no concerns about using alternative methods. Hence, there is likely to be significant variation in preferences between patients, with implications on staff workload in offering and assisting patients with alternative toileting methods.

To overcome this variation in preferences, a combination of strategies could be implemented for bladder emptying. Whilst waiting for environmental barriers to be resolved with better-designed ward layouts and easily accessible toilets, many other barriers could be addressed that may still reduce catheter duration. For example, for patients undergoing surgery, a

catheter can be utilised for the first 24 hours to get over the immediate post-operative discomfort then a shift could be made to alternative bladder emptying means to reduce the risk of infection.

6.3.4 Variations in ward level practice concerning the existing guidance

The HCP study identified considerable variations in the timing of catheter removal among different wards. Some wards removed catheters at midnight and others at 6am the morning after the catheter removal order was released, adding length to the catheter duration. Although some of the earlier research favours catheter removal at midnight to resume normal voiding patterns (Kelleher, 2002), this practice does not conform to the current UK or international guidance (Loveday *et al.*, 2014; Gould *et al.*, 2010). As per the guidance, a catheter should be removed as soon as there is no clinical indication for its continued use. The presence of these embedded routines of removing at midnight or in the early morning might fit better within the broader functioning of the ward in comparison to removing it through the day when a removal order is released. This might allow nursing staff more time for convenient observation and assessment of the patient's voiding, in comparison to the busier work schedule through the day (Crowe *et al.*, 1994). Since this doctoral research was conducted in one large NHS Trust in the North East of England, variations in catheter removal practices cannot be generalised beyond this organisation, or indeed the participating wards within the organisation. Nonetheless, this is an issue that warrants further exploration and the methodological approach taken in this thesis could set the stage for such broader research.

6.3.5 Forgetfulness and reminder interventions

Most of the nursing participants reported that due to other competing demands, they often place catheter removal low on their priority list (*Decision process*) or forget (*Memory*) to remove the catheter immediately after the removal order is released. Placing a low priority on catheter removal may be linked to HCPs' unawareness of the impact of unnecessary catheter duration on cumulative risk for developing bacteriuria i.e. 12 hours = 2.5%, 1 day = 5%.

The HCP participants found reminders from their peers, handover notes, and task check-list with the occasional reminder from patients helpful to remove the catheter. These reminders

took place on an ad-hoc basis with no specific frequency or structure. Reminder interventions such as criteria-based, computer-based, and verbal reminders from nurses to physicians, in addition to a placement of a sticker for catheter removal on a patient's chart, have proven to be effective in reducing the catheter duration and CAUTI rates (Meddings *et al.*, 2014), suggesting a more structured approach may be beneficial. However, acceptability of this approach to HCPs may be an issue. In line with Rousseau *et al.* (2003), HCP participants found pop-up computer-based reminders distracting and unhelpful but the majority were receptive to respond to reminders from patients or family. This supports the proposal in chapter five that future interventions should explore the role of patients and families in prompting or reminding HCPs to remove the catheter.

6.3.6 Hierarchy around catheter removal decision making and nurse-driven protocol interventions

Nurse-led protocols with pre-defined criteria for a catheter's continuation or discontinuation have proven to be effective in reducing catheter duration as described above (Skelly, 2008; Sadeghi *et al.*, 2019; Adams *et al.*, 2012). These interventions have the potential to empower nurses to make a catheter removal decision (*Social/professional role and identity*) and address the hierarchical barriers to making a catheter removal decision (*Social influences*).

6.3.7 Overall Summary of identified barriers

From the literature review (chapter three) and the empirical studies (chapters four and five), it is clear that the delay in catheter removal is a multi-faceted clinical problem. However, previous research has not conducted a comprehensive investigation to identify overall barriers around this multi-factorial problem involving both patients and HCPs. This gap was identified as the top limitation in Public Health England's report on the analyses of CAUTI prevention interventions (detailed in section 6.9), that the existing evidence lacks an understanding of specific behaviour related barriers and enablers related to CAUTIs (Atkins *et al.*, 2019 (In preparation)). There is value in conducting a detailed investigation of both perspectives systematically to examine all barriers using a robust and objective methodology to provide evidence for the most important and amenable barriers to be addressed. For instance, the work reported in this thesis identified knowledge as one of the main barriers for not only HCPs but also for patients, which prevented HCPs from promptly removing the catheters and patients from engaging in the catheter removal process. Knowledge is an

important factor in an attempt to improve an individual's learning and performance. But knowing what to do is not enough, the most important thing is understanding how to turn that knowledge into action (Pfeffer and Sutton, 1999). The application of knowledge into 'learning' and 'doing' takes place in complex contexts requiring individuals to overcome motivational, physical, social, and emotional barriers (Kahlke *et al.*, 2019). The current study found that the 'know-do' gap for HCPs is also interlinked with barriers such as forgetfulness, competing demands and resource issues in terms of high workload pushing catheter removal low on nurse's priority list. Thus, addressing the knowledge gap alone is insufficient to achieve the desired outcome. This may be the reason why educational interventions alone have not proven to be effective (Jones *et al.*, 2018). However, education combined with feedback on the consequent negative impact of CAUTIs (*Beliefs about consequences*) (Justus *et al.*, 2016) and incorporating formal daily catheter removal evaluations have proven to be effective in reducing catheter utilisation and CAUTI incidence (Menegueti *et al.*, 2019).

For patients, this research identified that the majority of them did not 'know' the impact of prolonged catheter duration on developing CAUTIs (*Knowledge*/*Beliefs about consequences*). This finding, combined with patients' misconceived ideas about urinary catheters as a result of deficiencies in the catheter consent process and beliefs around catheter removal decision being HCPs' sole responsibility (*Social/professional role and identity*), were potentially related to their lack of engagement in the catheter removal process. Moving forward, interventions could target specific and modifiable barriers affecting both HCPs and patients which have been identified in this body of research; this would have the potential to influence catheter removal practices and reduce the length of catheterisation.

6.4 Research findings in local healthcare setting context

The time taken for nurses to obtain a catheter removal order from medical staff was one of the main barriers which caused a delay in the catheter removal process. To a great extent, this finding reflects one of the four steps involved in the catheter removal process described earlier (Meddings *et al.*, 2010). In November 2018, local NHS Trust (NuTH) implemented a nurse-driven protocol, HOUDINI (Adams *et al.*, 2012), which bypasses some of these steps to

speed up the catheter removal process by empowering nurses to make the decision as well as remove the catheter by following a set of pre-defined removal indications (see Appendix M).

The HOUDINI intervention addresses two of several barriers identified in the HCP qualitative interview study (chapter four). These two barriers related to *Professional role and identity* (empowering nurses to make catheter removal decision), and *Social influences* (tackling hierarchical structure around catheter removal decision making). However, the HOUDINI intervention does not address the remainder of the barriers identified in this doctoral research, such as variation in catheter removal practices (midnight vs 6 am removal), a lack of evidence-based practice, a knowledge gap amongst both HCPs and patients, and a lack of information provided to patients during the catheter consent process. Besides, the existing interventions including HOUDINI do not explore the patient's role in providing reminders to speed up the removal process. Since its implementation, the HOUDINI intervention has not yet been formally evaluated locally. This highlights that there is much room for optimising and building on the HOUDINI intervention and presents an opportunity for future work where this intervention can be evaluated by building on the findings from this thesis.

Next steps in a local context: In the next research phase, the first step could be to further evaluate the HOUDINI intervention to assess its impact on catheter duration and CAUTI rates in the local NHS Trust. In the second phase, a supplementary intervention could be developed by mapping the remaining barriers to enhance the existing HOUDINI intervention, which is already embedded in local practice. The barriers to be addressed would be selected and prioritised on the basis that they are key barriers identified in the analysis of patient and HCP interviews, modifiable, most pressing, and not included in the HOUDINI intervention.

6.5 Future research

There are many behaviour change and implementation strategies that can be used to map the identified barriers, support and implement a specific behaviour, followed by incorporation of quality improvement methodology in intervention design and implementation. The barriers identified in this research were identified using the TDF. There is specific guidance available on how interventions can be designed to address barriers to behaviour change identified using the TDF and by incorporating the APEASE criteria (affordability, practicability, effectiveness,

acceptability, safety and equity) (Atkins *et al.*, 2017). Possible methods could include Behaviour Change Techniques (BCT Taxonomy) (Michie *et al.*, 2013), the Behaviour Change Wheel (Michie *et al.*, 2014), or with a combination of strategies from the Cochrane EPOC Taxonomy such as audit and feedback, education and reminder interventions with patient and family input (Effective Practice and Organisation of Care: 2015). Future interventions can be co-developed by including key stakeholders relevant to the catheter removal process.

A study in the clinical context of the 'sepsis six care bundle' used a similar approach to modify an existing intervention designed using the PDSA cycle, which proved to have achieved partial success in improving the implementation of the sepsis six bundle in a hospital setting (Steinmo *et al.*, 2016). The authors investigated the barriers influencing intervention implementation using TDF-based interviews with HCPs and developed modifications to the identified barriers to implementation using the BCT taxonomy (version 1) and APEASE criteria. This study found both of these tools to be compatible with the existing PDSA intervention which aimed to improve clinicians' behaviours and current practice to conform to evidence-based guidelines to carry out the six steps of sepsis treatment to be administered to patients within an hour of presentation at the hospital.

The catheter removal context represents a similar scenario in which the barriers to prompt catheter removal have been identified with the use of the TDF and there is an existing HOUDINI intervention being implemented in the local NHS practice, the impact of which is unclear both on reducing catheter duration and CAUTIs. The 'sepsis six' study could be used as an example to move current research forward to tackle modifiable barriers that are not yet addressed by the HOUDINI intervention. For example, variation in catheter removal practice (midnight vs 6am removal), nonconformity to current guidance, clinicians' forgetfulness causing a delay in catheter removal, a suboptimal catheter consent process, and inadequate information provision leading to patients' misguided ideas about catheters. Therefore, future work should focus on addressing modifiable barriers through the co-development of intervention strategies with relevant key stakeholders, i.e. patients and HCPs. The aim of this future work will be to supplement the HOUDINI intervention with these additional strategies to enhance improvement in local catheter removal practices.

6.6 Strengths of current work

The current research demonstrates a number of strengths. Overall, the main focus of the research was to conduct a detailed investigation of behaviours related to catheter removal and associated infections. This is an area of international importance. World-wide, hospital-acquired infections attributable to indwelling catheters affect patients who are receiving treatment during their hospital stay. One of the key contributing factors to infection is the longer duration of urinary catheters.

This research programme was novel in two ways; firstly, due to the application of the TDF in the clinical context of urinary catheters. Secondly, the use of the TDF in two separate studies, with patients and HCPs, combined in the same project. A detailed investigation into behaviour-related barriers and enablers provides an important, novel opportunity to enhance current understanding and move the current literature forward using established theory and methods to provide consistency in the literature going forward. This provides a robust foundation to support future development of an initiative to reduce catheter duration by tackling known modifiable barriers with a behaviour change intervention and, therefore, improve catheter care and safety.

Another strength of this thesis was the exploration of this multi-faceted issue by having the flexibility of semi-structured interviews, incorporating a range of perspectives, such as HCPs (nurses, doctors and healthcare assistants) and patients (admitted to medical and surgical wards), rather than limiting the research to HCPs only which has primarily been the case in the existing literature. Future intervention could be designed with insights gained from integrating healthcare professional and patient perspectives in ways not possible before this research.

The interviews were conducted during day and night shifts to capture variations in catheter care and practices related to different shift patterns. Once institutional and ethical approvals were gained, the potential participants were approached directly on the ward for participation to avoid coercion from staff (for patients) or the senior management team (for HCPs). Dedicated time was approved by the senior management team beforehand for HCP participants to take part in the interviews. This enabled staff to be relieved from their clinical

duties and allowed sufficient time to explore their beliefs and perceptions without being rushed on a variety of medical and surgical ward settings. Such practical approaches to data collection in this area may help to inform future investigations.

Methodologically, this research was conducted as per the nationally recommended standards and followed the UK MRC framework for developing and evaluating complex interventions (Craig *et al.*, 2008), described in chapter two. With the use of a theory-based approach, this doctoral research focused on the development phase of the MRC framework, by identifying the evidence base and barriers/enablers from key stakeholders' point of view. This helped to: develop an understanding of the processes and factors around the clinical problem of CAUTIs, synthesise evidence with the use of a theoretical framework necessary to develop tailored interventions, and is of relevance to key stakeholders. Interview studies were conducted with the application of rigorous research methods, such as independent coding by a second coder and discussions in data clinics with the wider research team to drive meaningful conclusions. Both interview studies (chapters four and five) have been reported as per the COnsolidated criteria for REporting Qualitative research (COREQ) guidelines (Tong *et al.*, 2007).

The Patient and Public Involvement and Engagement (PPIE) panel members provided their input at every stage of this research. This included their involvement in confirmation of the CAUTI topic as a priority area worthwhile of research for patients, in the study design at the fellowship application stage to the NIHR, as members of the project team, helping to develop documents, provide input in the analysis process to draw meaningful conclusions, and finally in dissemination of the research findings (see Acknowledgements). The PPIE work on this project has been highly commended; for example, my co-dissemination work with one of the PPIE panel members (Mr Peter Michel) entitled 'Innovative ways to involve PPI' won the first prize for best oral presentation at the NIHR PPI conference (2017). I also co-wrote and submitted an abstract (April 2017) with a PPI member for the NIHR INVOLVE@21 PPI Conference (2017) in London. Overall, the work included in the thesis is deemed to be of publishable quality as demonstrated by the presentation of empirical findings at internationally recognised research conferences and the publication of abstracts in related peer-reviewed journals, invited presentations and dissemination during overseas research visits to Canada as part of my fellowship programme (see Thesis outputs).

6.7 Limitations of this research

This research should also be interpreted in light of limitations. The specific limitations of each study have been noted in the respective empirical chapters and the overall limitations are discussed in this section. The participants were recruited with criteria-based sampling strategy which can be prone to researcher bias such as recruiting easily available participants (Laerd, 2012). To minimise these possible biases, a heterogeneous mix of catheter insertion indications (patients) and a variety of HCPs involved in the catheter removal process (nurses, doctors and healthcare assistants) were included to capture a wide range of attributes and perspectives. The nature of the sampling strategy was inclusive rather than exclusive to gain understanding from a diversity of perspectives. In the patient study, the only participants included in the study were those who required short term catheters, so it is not possible to generalise to those with long-term catheters. The study took place in the secondary care setting so the findings cannot reliably be applied to other contexts e.g. patients in the community setting with a long-term catheter in-situ. However, the patient interview sample had wide-ranging sociodemographic characters and a variety of medical and surgical indications for catheter insertion. This lends strength to the likelihood that the main barriers drawn from this body of research are transferable to other clinical areas in the secondary care setting for patients with short-term urinary catheters in-situ. An exception to this would be the identified variation in catheter removal practices (midnight or 6am) since this finding may reflect practice unique to the local NHS Trust. Future work should explore this feature on a larger scale.

It has been noted previously in the literature review (chapter three) and throughout this thesis that delayed catheter removal is a complex phenomenon with multi-factorial diverse influences and barriers related to patients and HCPs. Moving this research forward, it may not be possible to address all of the identified barriers immediately. For example, barriers relating to environmental factors such as shared toilet facilities and a lack of ample toilets in a patient's vicinity are barriers which can only be addressed by making structural building changes to the ward layout and would require significant financial resources. However, the ward layout in newly built hospital premises is moving towards providing en-suite facilities to patients where possible (Bhardwaj *et al.*, 2012). Due to restricted resources, providing en-suite facilities may not be possible at all in the other NHS hospitals in the country or hospitals in less developed

countries (De Geyndt, 1995). In the meantime, however, there are still many barriers that could be addressed.

The data collection and analysis were both guided by the framework method using the TDF (Michie *et al.*, 2005). A framework method can raise questions about its potential application in data collection and initial analysis in a deductive manner (Francis *et al.*, 2012). To counter this, the current work used an inductive approach to the coding of themes within domains. Another critique is the potential for superficial application of the TDF (Francis *et al.*, 2012). However, if used effectively by an experienced researcher, superficial application of the framework can be avoided and it can provide a systematic structure to conduct interviews whilst providing flexibility to adapt the framework to a given clinical context (Gale *et al.*, 2013). Furthermore, use of a deductive approach can help to draw upon a pre-existing theory or a theoretical framework (Mayring, 2000; Vaismoradi *et al.*, 2013).

The research reported in this thesis first defined the specific target behaviours for patient and HCPs (Francis and Presseau, 2019) then adopted the framework (TDF) to the clinical context of urinary catheters (Michie *et al.*, 2005) and finally adopted a hybrid method of content analysis with the use of deductive and inductive approaches to coding and theme development (Fereday and Muir-Cochrane, 2006). The rationale for, and critique of, the TDF has been detailed in the literature review (chapter three). Collectively, this approach facilitated drawing a context-specific description of barriers and enablers related to catheter duration.

The work conducted in this thesis was led by a single researcher and could, therefore, be prone to subjectivity. To minimise the potential impact of biases, this body of research has been consistently reviewed, appraised and critiqued by clinical and academic experts in the field, as well as lay expert members. This included: a critique by my PhD supervision team consisting of methodological and clinical experts in the fields of qualitative methods, application of psychological theory, theoretical frameworks, behaviour change techniques, patient safety, and urology/incontinence. Also, codes in the analysis process were double-coded and cross-checked by an independent researcher. My work was also scrutinised during annual appraisals by two independent assessors consisting of a senior Professor of Health Service Research and

an Academic Clinician (Consultant Urological Surgeon); by the PPI panel, and through peer-review by national and international conference panels.

6.8 Potential impact

The finding of this doctoral research has been shared with a wide audience and is anticipated to produce impact at local, national and European levels, detailed below.

6.8.1 Impact on the local practice

Variations in catheter removal practice: The issue of variation in catheter removal timing (midnight vs 6am removal) is inconsistent with currently recommended guidance. The UK guidance suggest that the catheter should be removed as soon as possible (Loveday *et al.*, 2014) and American CDC guidance (Gould *et al.*, 2010) suggests catheter removal within 24 hours (1 day). Despite this, average post-operative catheter duration remains too long at 3 days (Pickard *et al.*, 2012a). This non-concordant practice is one of the potential reasons for delays in catheter removal depending on the time the catheter removal order is released. For example, if the decision for catheter removal was made at a multi-disciplinary ward round in the morning. By not removing it immediately and removing it either at midnight that day or at 6am the next morning, it adds a half or full day to catheter duration. This puts patients at an increased risk of developing bacteriuria by 2.5% (half day) or 5% (full day), respectively (Gokula *et al.*, 2004; Fukuoka *et al.*, 2018). To address this issue the findings from this doctoral research have been shared with the relevant stakeholders in the local NHS Trust i.e. The Catheter Care Sub Group (CCSG), Infection Prevention and Control (IPC) representatives, and Director of Nursing for streamlining the timing of catheter removal practice across different wards, which would conform to the national standard within the local NHS Trust.

6.8.2 Estimated impact on reducing catheter duration and CAUTI rates

Future intervention/s will be designed with a focus on bringing about a reduction in catheterised days (primary outcome) and associated CAUTIs (secondary outcome). Reduction in average hospital catheter duration from the current average of 3 days (Pickard *et al.*, 2012a) down to 1 day (as suggested by CDC guidance (Gould *et al.*, 2010)), could reduce CAUTI incidence by a third. This could avoid around 80,000 of over 2 million catheterised patients

undue suffering, with a potential saving of £44 million annually to the UK NHS in terms of the direct cost of treating CAUTIs (80,000 at £548 per CAUTI for annual treatment (Pickard *et al.*, 2012b). Other related benefits would be a reduction in morbidity and sepsis mortalities, getting patients home earlier, improved Quality of Life (QoL), and reducing healthcare-acquired infections. Consistent with the MRC framework (Craig *et al.*, 2008), if the intervention proves to be effective in reducing catheter duration, it can be tested in multiple NHS hospitals for its safety, feasibility and acceptability, followed by a multi-centre cluster randomised controlled trial for intervention assessment and evaluation at large scale.

6.8.3 Potential impact on the UK and European guidelines

The current research highlights a gap in multiple sources of UK clinical guidelines for preventing healthcare-associated infections including urinary catheters, one of the major causes of HAIs and one that can be rectified to be in line with international standards, namely the CDC. These guidance documents include NICE (CG139: (National Institute for Health and Care Excellence, 2012)) on 'Healthcare-associated infections: prevention and control in primary and community care', NICE (QS61: (National Institute for Health and Care Excellence, 2014)) on 'Infection prevention and control' including Urinary catheters (QS4), Saving Lives (Department of Health, 2007), and epic3 guidelines (Loveday *et al.*, 2014). The duration of catheterisation is considered to be the most important risk factor for developing bacteriuria (Maki and Tambyah, 2001; Saint and Lipsky, 1999), therefore, the timing of catheter removal is imperative in preventing CAUTIs. The American CDC guidance provides specific guidance on the timing of catheter removal suggesting that a catheter should be removed preferably within 24 hours unless there are appropriate indications for continued use (Gould *et al.*, 2010) (updated 2019). However, the UK guidance lacks specificity on the timing of catheter removal. The Saving Lives High Impact Intervention No 6. epic2 guidance (2007), urinary catheter care bundle suggests: review regularly and remove the catheter as soon as possible (Pratt *et al.*, 2007), and more recent guidance documents epic3 (2014) states *"remove the catheter when no longer clinically indicated"* (Loveday *et al.*, 2014, p.33), and NICE QS61 *"removal as soon as it is no longer needed"* (National Institute for Health and Care Excellence, 2014, p.23). These guidance statements have no reference to the specific timing of conducting catheter removal assessments or their removal. Such wording becomes open to subjective interpretation due to a lack of evidence. The guidance needs to be specific especially when there is high reliability on reducing the catheter duration to reduce CAUTIs.

Similarly, European guidelines on urological infections (Bonkat *et al.*, 2017) by the European Association of Urology (EAU) primarily focuses on the management of CAUTIs with antibiotic treatment. In terms of catheter duration, this document also does not specify a timeframe for catheter removal stating "*the duration of catheterisation should be minimal*" (Bonkat *et al.*, 2017, pg 20-22). These gaps in the guidelines need to be addressed with the provision of concise information to HCPs on the timing of catheter removal, similar to the American CDC guidance.

I have begun an engagement process with stakeholders and guidance makers and have flagged these gaps with the UK NICE and European guideline panels. The Communications Executive at the UK NICE panel has agreed to review QS61 guidance quality statement (detailed in literature chapter three) as part of their annual review process to determine the need for amendment (and to consider the work presented in this thesis). The QS61 review may potentially be scheduled into the work programme for the year 2020. Similarly, an engagement process with the EAU guidelines panel for Urological Infections has been initiated. This includes an arrangement for published work of this research to be considered at the panel meeting with the overall objective of updating relevant sections in the current guidance.

6.9 Conclusion

CAUTIs are widespread and affect millions of people worldwide every year. Despite existing local, national and international initiatives to reduce CAUTIs, the current local practice was found to be non-concordant with recommended guidance. Due to the high incidence and impact of CAUTIs, it was necessary to gain greater insight on what factors contribute to the delay in catheter removal and the development of resulting CAUTIs, from both a HCP and patient perspective.

This body of research has explored a wide range of physical, social, emotional, and environmental factors (barriers and facilitators) that influence patients' and HCPs' behaviours associated with duration of short-term urinary catheters. Informed by a comprehensive theoretical framework (TDF) this research included: a review of the current clinical guidance, a literature review of existing interventions focused to reduce catheter duration and

associated CAUTIs, and two theory-based qualitative interview studies with catheterised patients and HCPs from medical and surgical wards in a secondary care setting.

To my knowledge, the research presented in this thesis is the first comprehensive investigation to identify barriers and facilitators related to delays in the catheter removal process and to look at this from both provider and patient perspectives. The findings are timely and have the potential for broad impact. Furthermore, the findings fill an evidence gap in the literature, propose gaps in current UK guidance, and address two out of three major limitations highlighted in a project commissioned by Public Health England (PHE) on strategic behavioural analyses of interventions for CAUTI prevention (Atkins *et al.*, 2019 (In preparation)). The main limitation described in the PHE project report was that existing research focuses on bundle interventions rather than identifying specific behaviour related barriers and enablers. The second limitation that the PHE report highlights is a lack of detailed investigation of barriers and enablers using the TDF is likely to result in missed CAUTI-related behaviours. The current research addresses these limitations specifically by filling the evidence gap in the current literature and by suggesting which barriers are appropriate and modifiable to address in an intervention. It also provides the basis to develop a behaviour change intervention which can be targeted at both HCPs and patients and develop implementation strategies to the prompt removal of urinary catheters to reduce CAUTIs.

Key messages from this research:

- Reducing catheter duration and related infections is important locally, nationally and internationally to help address the global problem of CAUTIs.

- Delayed catheter removal and CAUTIs are a product of a complex set of multi-factorial interrelated behaviours associated with multiple individuals including doctors, nurses, support staff and patients.

- Catheter removal assessments are not conducted daily by HCPs to assess the continued need for catheterisation. This is important for the timely removal of catheters to avoid unnecessary CAUTIs.

- The reason for the continued use of the catheter is not always documented in the clinical/nursing notes which should be done daily. This is important for establishing appropriate indications for catheter's continued use.

- The UK and European guidance documents need clarity and specificity on the timing of catheter removal. A single statement on catheter removal without time specificity is not enough to provide precise instructions to clinicians when the existing evidence supports safe catheter removal within a specified time frame.

- Patients should be made aware of the consequences of prolonged catheter duration as part of the consent process which is currently lacking in the local practice.

- To improve current practice, a change in both HCP and patient behaviour (and key drivers to their behaviour) is required. Future interventions should consider targeting both parties for the prompt removal of catheters.

- The current research identified behavioural determinants of key patient and HCP behaviours influencing CAUTIs and lays the foundation for the next phase of research to address these barriers.

Appendix A: Theoretical Domains Framework construct definitions

Construct	Definition
Ability	Competence or capacity to perform a physical or mental act. Ability may be either unlearned or acquired by education and practice.[2]
Action planning	The action or process of forming a plan regarding a thing to be done or a deed.[7]
Affect	An experience or feeling of emotion, ranging from suffering to elation, from the simplest to the most complex sensations of feelings, and from the most normal to the most pathological emotional reactions.[1]
Alienation	Estrangement from one's social group; a deep seated sense of dissatisfaction with one's personal experiences that can be a source of lack of trust in one's social or physical environment or in oneself; the experience of separation between thoughts and feelings.[1]
Anticipated regret	A sense of the potential negative consequences of a decision that influences the choice made: for example an individual may decide not to make an investment because of the feelings associated with an imagined loss.[1]
Anxiety	A mood state characterised by apprehension and somatic symptoms of tension in which an individual anticipates impending danger, catastrophe or misfortune.[1]
Appraisal	The cognitive evaluation of a phenomenon or event. In theories of emotions, cognitive appraisals are seen as determinants of emotional experience.[1]
Attention	A state of awareness in which the senses are focussed selectively on aspects of the environment and the central nervous system is in a state of readiness to respond to stimuli.[1]
Attention control	The extent to which a person can concentrate on relevant cues and ignore all irrelevant cues in a given situation.[2]
Attitudes	Any subjective belief or evaluation associated with an object or behaviour.[2]
Barriers and facilitators	In psychological contexts barriers/facilitators are mental, emotional or behavioural limitations/strengths in individuals or groups.[1]
Beliefs	The thing believed; the proposition or set of propositions held true.[6]
Breaking habit	To discontinue a behaviour or sequence of behaviours that is automatically activated by relevant situational cues.[2]
Burn-out	Physical, emotional or mental exhaustion, especially in one's job or career, accompanied by decreased motivation, lowered performance and negative attitudes towards oneself and others.[1]

Certainty of intentions	Assuredness of one's resolve to act in a certain way. [7]
Champions/To champion	To fight for another or for a cause.[15]
Change Management	A process during which the changes to a system are implemented in a controlled manner by following a pre-defined framework.
Characteristics of outcome expectancies	Characteristics of the cognitive, emotional and behavioural outcomes that individuals believe are associated with future or intended behaviours and that are believed to either promote or inhibit these behaviours. These include whether they are sanctions/rewards, proximal/distal, valued/not valued, probable/improbable, salient/not salient, perceived risks or threats.[2]
Cognitive overload/tiredness	The situation in which the demands placed on a person by mental work are greater than a person's mental abilities.[1]
Commitment	The act of binding yourself (intellectually or emotionally) to a course of action.[5]
Competence	One's repertoire of skills, and ability especially as it is applied to a task or set of tasks.[2]
Conflict - competing demands, conflicting roles	The actual or perceived incompatibility between the performance of two or more behaviours.[2]
Consequents	An outcome of behaviour in a given situation.[1]
Contingencies	A conditional probabilistic relation between two events. Contingencies may be arranged via dependencies or they may emerge by accident.[1]
Control of behaviour, material and social environment	Authority, power or influence over events, behaviours, situations or people. [2]
Coping strategies	An action, series of actions, or a thought process used in an attempt to reduce stress or used to modify one's reaction to a stressful/unpleasant situation. Coping strategies typically involve a conscious and direct approach to problems.[2]
Crew resource management	A management system that makes optimum use of all available resources, equipment, procedures and people.[8]
Decision making	The cognitive process of choosing between two or more alternatives, ranging from the relatively clear cut to the complex.[1]
Depression	A mental state that presents with depressed mood, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, low energy, and poor concentration.[11]
Direct experience	The experience gained through immediate sense perception.[8]
Empowerment	The promotion of the skills, knowledge and confidence necessary to take great control of one's life as in certain educational or social schemes; the delegation of increased decision-making powers to individuals or groups in a society or organisation.[1]
Environmental stressors	External factors in the environment that cause stress.[2]

Evaluation	A careful examination or overall appraisal of something to determine its worth, value or desirability; a determination of the success of something in achieving defined goals; the interpretation of test results and experimental data.[1]
Fear	An intense emotion aroused by the detection of imminent threat, involving an immediate alarm reaction that mobilises the organism by triggering a set of physiological changes.[1]
Feedback	The return of information about progress on or the outcome of a process or activity.[16]
Generating alternatives	Thinking of other ways of dealing with a situation or problem.[2]
Goal priority	Order of importance or urgency of end states toward which one is striving.[2]
Goal/target setting	A process that establishes specific time based behaviour targets that are measurable, achievable and realistic.[1]
Goals (autonomous/controlled)	The end state toward which one is striving: the purpose of an activity or endeavour. It can be identified by observing that a person ceases or changes its behaviour upon attaining this state; proficiency in a task to be achieved within a set period of time.[2]
Goals (distal/proximal)	Desired state of affairs of a person or system, these may be closer (proximal) or further away (distal).[8]
Group conformity	The act of consciously maintaining a certain degree of similarity to those in your general social circles.[8]
Group identity	The set of behavioural or personal characteristics by which an individual is recognizable [and portrays] as a member of a group.[8]
Group norms	Any behaviour, belief, attitude or emotional reaction held to be correct or acceptable by a given group in society.[7]
Hierarchy	A clear order of individuals on some behavioural dimension such as dominance-submission.[1]
Identity	An individual's sense of self defined by a) a set of physical and psychological characteristics that is not wholly shared with any other person and b) a range of social and interpersonal affiliations (e.g., ethnicity) and social roles.[1]
Illness representations	Organised beliefs of illness acquired through the media, personal experience and from family and friends' experiences, beliefs, descriptions and knowledge of particular disorders.[3]
Implementation intention	The plan that one creates in advance of when, where and how one will enact a behaviour.[8]
Incentives	An external stimulus, such as condition or object, that enhances or serves as a motive for behaviour.[1]
Intention	A conscious decision to perform a behaviour; a resolve to act in a certain way or an impulse for purposeful action. In experiments, intention is often equated with goals defined by the task instruction.[1]

Intergroup conflict	Disagreement or confrontation between two or more groups and their members. This may involve physical violence, interpersonal discord, or psychological tension.[13]
Interpersonal skills	An aptitude enabling a person to carry on effective relationships with others, such as an ability to cooperate, to assume appropriate social responsibilities or to exhibit adequate flexibility.[1]
Intrinsic motivation	An incentive to engage in a specific activity that derives from the activity itself rather than because of any external benefits that might be obtained.[1]
Knowledge	An awareness of the existence of something.[1]
Knowledge of task environment	Knowledge of the social and material context in which a task is undertaken.[2]
Leadership	The processes involved in leading others, including organising, directing, coordinating and motivating their efforts toward achievement of certain group or organisation goals.[1]
Learning	The process of acquiring new and relatively enduring information, behaviour patterns or abilities, characterised by modification of behaviour as a result of practice, study or experience.[1,5]
Management commitment	The binding of a governing body of an organization or business to a course of action.[7]
Memory	The ability to retain information or a representation of a past experience, based on the mental processes of learning or encoding retention across some interval of time, and retrieval or reactivation of the memory; specific information of a specific past.[1]
Mindset	An established set of attitudes regarded as typical of a particular group's social or cultural values; the outlook, philosophy, or values of a person; frame of mind, attitude, disposition.[6]
Modelling	In developmental psychology the process in which one or more individuals or other entities serve as examples (models) that a child will copy.[1]
Moderators of the intention behaviour gap	Factors that affect the relationship between what one intends to do and what one actually does.
Negotiation	A reciprocal communication process in which two or more parties to a dispute examine specific issues, explain their positions and exchange offers and counter-offers in an attempt to identify a solution or outcome that is acceptable to all parties.[1]
Optimism	The attitude that outcomes will be positive and that people's wishes or aims will ultimately be fulfilled.[2]
Organisational commitment	An employee's dedication to an organisation and wish to remain part of it. Organisational commitment is often described as having both an emotional or moral element and a more prudent element.[1]

Organisational culture/climate	A distinctive pattern of thought and behaviour shared by members of the same organisation and reflected in their language, values, attitudes, beliefs and customs.[1]
Organisational development	The application of principles and practices drawn from psychology, sociology and related fields to the planned improvement of organisational effectiveness.[1]
Outcome expectancies	Cognitive, emotional, behavioural, and affective outcomes that are assumed to be associated with future or intended behaviours. These assumed outcomes can either promote or inhibit future behaviours.[2]
Past behaviour	Previous manner of conducting oneself.[7]
Perceived behavioural control	An individual's perception of the ease or difficulty of performing the behaviour of interest.[9]
Perceived competence	An individual's belief in his or her ability to learn and execute skills.[1]
Person x environment interaction	Interplay between the individual and their surroundings.
Pessimism	The attitude that things will go wrong and that people's wishes or aims are unlikely to be fulfilled.[1]
Positive/negative affect	The internal feeling/state that occurs when a goal has/has not been attained, a source of threat has/has not been avoided, or the individual is/is not satisfied with the present state of affairs.[1]
Power	The capacity to influence others, even when they try to resist this influence.[1]
Practice	Repetition of an act, behaviour, or series of activities, often to improve performance or acquire a skill.[1]
Procedural knowledge	Knowing how to do something.[4]
Professional boundaries	The bounds or limits relating to, or connected with a particular profession or calling.[7]
Professional confidence	An individual's belief in his or her repertoire of skills, and ability especially as it is applied to a task or set of tasks.[7]
Professional identity	The characteristics by which an individual is recognised relating to, connected with or befitting a particular profession.[7]
Professional role	The behaviour considered appropriate for a particular kind of work or social position.[7]
Project management	Defining and achieving targets while optimizing the use of resources over the course of a project.[8]
Punishment	The process in which the relationship between a response and some stimulus or circumstance results in the response becoming less probable; a painful, unwanted or undesired event or circumstance imposed as a penalty on a wrongdoer.[1]
Reinforcement	A process in which the frequency of a response is increased by a dependent relationship or contingency with a stimulus.[2]

Representation of tasks	A mental model of goal-directed activities.[2]
Resources/material resources	Commodities and human resources used in enacting a behaviour.[2]
Review	To look over or through in order to correct or improve; to revise.[6]
Rewards (proximal/distal, valued/not valued, probable/improbable)	Return or recompense made to, or received by a person contingent on some performance.[7]
Routine/automatic/habit	A well-learned behaviour or automatic sequence of behaviours that is relatively situation specific. At its extreme the behaviour has become a reflex; independent of motivation, cognitive influence or conscious control.[2]
Salient events/critical incidents	Occurrences that one judges to be distinctive, prominent or otherwise significant.[2]
Sanctions	A punishment or other coercive measure, usually administered by a recognised authority, that is used to penalise and deter inappropriate or unauthorised actions.[1]
Schemas	A collection of basic knowledge about a concept or entity that serves as a guide to perception, interpretation, imagination or problem solving.[1]
Self-confidence	Self-assurance or trust in one's own abilities, capabilities and judgment.[1]
Self-efficacy	An individual's capacity to act effectively to bring about desired results, as perceived by the individual.[2]
Self-esteem	The degree to which the qualities and characteristics contained in one's self- concept are perceived to be positive.[1]
Self-monitoring	A method used in behavioural management in which individuals keep a record of their behaviour, especially in connection with efforts to change or regulate the self; a personality trait reflecting an ability to modify one's behaviour in response to situation.[1]
Sensitisation	A form of non-associative learning in which an organism becomes more responsive to most stimuli after being exposed to unusually strong or painful stimuli; the increased effectiveness of an eliciting stimulus as function of its presentation.[1]
Skill assessment	A judgment of the quality, worth, importance, level, or value of an ability or proficiency acquired through training and practice.[2]
Skills	An ability or proficiency acquired through training and/or practice.[2]
Skills development	The gradual acquisition or advancement through progressive stages of an ability or proficiency acquired through training and practice.[2, 7]
Social comparisons	The process by which people evaluate their attitudes, abilities, or performance relative to others.[14]

Social identity	The set of behavioural or personal characteristics by which an individual is recognizable [and portrays] as a member of a social group.[1]
Social norms	Socially determined consensual standards that indicate a) what behaviours are considered typical in a given context and b) what behaviours are considered proper in the context.[1]
Social pressure	The exertion of influence on a person or group by another person or group.[1]
Social support	The apperception or provision of assistance or comfort to others, typically in order to help them cope with a variety of biological, psychological and social stressors. Support may arise from any interpersonal relationship in an individual's social network, involving friends, neighbours, religious institutions, colleagues, caregivers or support groups.[2]
Stability of intentions	Ability of one's resolve to remain in spite of disturbing influences.[7]
Stages of Change model	A model that proposes that behaviour change is accomplished through five specific stages: Pre-contemplation, Contemplation, Preparation, Action, and Maintenance.[17]
Stress	A state of physiological or psychological response to internal or external stressors.[1]
Supervision	Management by overseeing the performance or operation of a person of group.[12]
Team working	Cooperative effort toward a common goal or on a common project.[1]
Threat	A condition that is appraised as a danger to oneself or well-being or to a group.[1]
Trans-theoretical model and stages of change	A five-stage theory to explain changes in people's health behaviour. It suggests that change takes time, that different interventions are effective at different stages, and that there are multiple outcomes occurring across the stages.[1]
Unrealistic optimism	The inert tendency for humans to over-rate their own abilities and chances of positive outcomes compared to those of other people.[10]

(superscript number refers to definition source; definitions directly from (Cane *et al.*, 2012))

N.B. Definitions for the original Theoretical Domains Framework domains are available from the first author on request.
Definition source (construct labels were used as keywords in each of the definition searches; see reference section for full citations): [1] APA Dictionary of Psychology [36], [2] Based on definition(s) from APA Dictionary of Psychology [36], [3] Based on definition from Taylor (2003) [55], [4] The Macmillan Dictionary of Psychology (2nd Edition) [56], [5] Based on definition from WordNet [57], [6] Oxford English Dictionary Online [58], [7] Based on definition(s) from Oxford English Dictionary Online [58], [8] Based on definition from En.wikipedia.org/wiki entry [59], [9] Based on definition from Azjen (1991) [60], [10] Based on definition from Ogden (2000) [61], [11] World Health Organisation (WHO) [62], [12] Dictionary.com [63], [13] Forsythe (2009) [64], [14] Based on definition from Alicke (2000) [65], [15]

YourDictionary.com [66], [16] The Free Dictionary [67], [17] Based on definition from Proschaska and DiClemente (1984) [68].

Appendix B: TDF domains, constructs and sample questions *

	Domain	Constructs	Questions
1	Knowledge	Knowledge Knowledge about condition/scientific rationale Schemas + mindsets + illness representations Procedural knowledge	Do they know about the guideline? What do they think the guideline says? What do they think the evidence is? Do they know they should be doing x? Do they know why they should be doing x?
2	Skills	Skills Competence/ability/skill assessment Interpersonal skills Coping strategies	Do they know how to do x? How easy or difficult do they find performing x to the Practice/skills development required standard in the required context?
3	Social/professional role and identity	Identity Professional identity/boundaries/role Group/social identity Social/group norms Alienation/organisational commitment	What is the purpose of the guidelines? What do they think about the credibility of the source? Do they think guidelines should determine their behaviour?
4	Beliefs about capabilities	Self-efficacy Control—of behaviour and material and social environment Perceived competence	How difficult or easy is it for them to do x? (prompt re. internal and external capabilities/constraints)

		Self-confidence/professional confidence Empowerment Self-esteem Perceived behavioural control Optimism/pessimism	What problems have they encountered? What would help them? How confident are they that they can do x despite the difficulties? How capable are they of maintaining x? How well equipped/comfortable do they feel to do x?
5	Beliefs about consequences	Self-efficacy Control—of behaviour and material and social environment Perceived competence Self-confidence/professional confidence Empowerment Self-esteem Perceived behavioural control Optimism/pessimism	What do they think will happen if they do x? (prompt re themselves, patients, colleagues and the organisation; positive and negative, short term and long term consequences) What are the costs of x and what are the costs of the consequences of x? What do they think will happen if they do not do x? (prompts) Do benefits of doing x outweigh the costs? How will they feel if they do/don't do x? (prompts) Does the evidence suggest that doing x is a good thing?
6	Motivation and goals (Intention)	Intention; stability of intention/certainty of intention Goals (autonomous, controlled) Goal target/setting Goal priority Intrinsic motivation Commitment	How much do they want to do x? How much do they feel they need to do x? Are there other things they want to do or

		Distal and proximal goals Trans-theoretical model and stages of change	achieve that might interfere with x? Does the guideline conflict with others? Are there incentives to do x?
7	Memory, attention and decision processes	Memory Attention Attention control Decision making	Is x something they usually do? Will they think to do x? How much attention will they have to pay to do x? Will they remember to do x? How? Might they decide not to do x? Why? (prompt: competing tasks, time constraints)
8	Environmental context and resources	Resources/material resources (availability and management) Environmental stressors Person x environment interaction Knowledge of task environment	To what extent do physical or resource factors facilitate or hinder x? Are there competing tasks and time constraints? Are the necessary resources available to those expected to undertake x?
9	Social influences	Social support , Social/group norms, Organisational development, Leadership, Team working, Group conformity, Organisational climate/culture, Social pressure, Power/hierarchy, Professional boundaries/roles, Management commitment, Supervision, Inter-group conflict, Champions, Social comparisons, Identity; group/social	To what extent do social influences facilitate or hinder x? (prompts: peers, managers, other professional groups, patients, relatives)

		identity, Organisational commitment/alienation, Feedback, Conflict—competing demands, conflicting roles, Change management, Crew resource management, Negotiation, Social support: personal/professional/organisational, intra/, interpersonal, society/community Social/group norms: subjective, descriptive, injunctive norms, Learning and modelling	Will they observe others doing x (i.e. have role models)?
10	Emotion	Affect Stress Anticipated regret Fear Burn-out Cognitive overload/tiredness Threat Positive/negative affect Anxiety/depression	Does doing x evoke an emotional response? If so, what? To what extent do emotional factors facilitate or hinder x? How does emotion affect x?
11	Behavioural regulation	Goal/target setting Implementation intention Action planning Self-monitoring Goal priority Generating alternatives Feedback Moderators of intention-behaviour gap Project management Barriers and facilitators	What preparatory steps are needed to do x? (prompt re individual and organisational) Are there procedures or ways of working that encourage x?
12	Nature of the behaviours	Routine/automatic/habit Breaking habit Direct experience/past behaviour Representation of tasks Stages of change model	What is the proposed behaviour (x)? Who needs to do what differently when, where, how, how often and with whom? How do they know whether the behaviour has happened? What do they currently do? Is this a new behaviour or an existing behaviour

	that needs to become a habit? Can the context be used to prompt the new behaviour? (prompts: layout, reminders, equipment) How long are changes going to take? Are there systems for maintaining long-term change?

* Note- Reproduced from (Michie *et al.*, 2005, Table 1)

Appendix C: Healthcare professional- interview schedule for Chapter 4

Participant initials		Age	
Participant study number		Gender	
		Speciality	
		Designation	
		Number of years since qualified	

Format

- Greeting & thank you for agreeing to be interviewed for the study
- Explain aim of the study in detail and what I would like to get out of this interview
- Recording of interviews for transcription - assurances of anonymity and confidentiality
- The interview will take around 1 hour
- Can stop at any time you wish
- There are no right or wrong answers - we are interested in hearing all perspectives
- Please feel free to talk about other related important things that come to your mind
- Any questions or concerns we can address during the interview or at the end
- Close interview

Introduction: Thank you for agreeing to take part in the interview. In this study we would like to understand reasons that delay or promote timing of catheter removal in practice.

There are quite a few questions that I would like to go through which I have written down on this piece of paper. I will be referring to it from time to time, so please don't get put off by me looking at it. This is just to make sure that we are on track and that I haven't missed anything. I may occasionally make notes for my reference later and some questions may sound a bit repetitive. If any question doesn't make sense please let me know and I will be happy to rephrase the question to simplify.

Remember, there are no right or wrong answers; I would be useful to hear all perspectives.

1. Okay, so if you'd like to start with telling me about **your experiences** around urinary catheters?

2. Are you aware of the local, national or international guidance on short-term urinary catheters?

3. What does the ***guideline/s say*** around the timing of catheter removal? (*establish the standard)*

4. Do you follow the guideline/s in your practice? (establish current practice)

5. On your ward is there a **set guideline for removing the catheter** for particular procedures?

   Prompts- hospital guideline, ward policy

6. *If yes, **do you follow that guideline/s**?* **(Behaviour Regulation)**

Knowledge

7. Can you tell me about the **risks involved** around catheterisation?

8. What do you think the **evidence** is around removing the timing of catheter removal?

Prompt- knowledge testing, in support for early or late removal

9. Do you know **when** you should remove the catheter? *Prompts- If yes- how? If no- why not?*

10. Do you know **why** the catheter should be removed as quickly as possible?

Skills and beliefs about capabilities

11. Are you **capable** of removing a catheter of patients under your care promptly?

12. How did you achieve this capability? Prompts- through training, learning from colleagues

13. Are you **confident** in removing a catheter of patients under your care promptly?

14. Are there any **interpersonal relationships (rapport)** that are required with **patients or your colleagues** to remove the catheter promptly?

Social/professional role and identity (self-standards)

15. Is removing a catheter **part of your role**?

16. In what ways removing the catheter promptly is **compatible** with professional standards?

Prompts- moral or ethical issues, limits to autonomy, NMC/GMC code of conduct

17. In what ways removing the catheter promptly **conflict** with professional standards?

Prompts- moral or ethical issues, limits to autonomy, NMC/GMC code of conduct

Beliefs about capabilities

18. Do you **find it easy** to remove the catheter promptly?

Prompts- internal and external factors and constraints

19. Do you **find it difficult** to remove the catheter promptly?

20. **If yes**, **how difficult** do you find removing the catheter promptly?

21. What **difficulties or problems have you encountered in your experience to** remove the catheter within 24 hours?

22. What would **help you to overcome these problems**?

Prompts- further training, support from colleagues

23. How **confident** are you to remove the catheter promptly despite the difficulties?

Prompts- self-drive, motivation

24. **What makes it easier** in your experience to remove the catheter promptly?

25. Are you **capable of maintaining your practice** of removing the catheter promptly?

26. **If yes, how** do you do that?

Prompts- self-reminders, prompts by colleagues

27. **If not,** is that something you might consider?

Prompts- If yes, how would you change your current practice? If not- why not?

Emotion

28. Do you **feel comfortable** removing the catheter promptly?

Skills

29. Are you **well equipped** to remove the catheter promptly?

Beliefs about consequences

30. What do you think would happen if you **do** remove the catheter promptly?

Prompts- consequences to yourself, patients, colleagues, organisation, positive and negative, short term and long term consequences

31. What do you think will happen if you **don't** remove the catheter promptly?

32. What do you think the **costs** are around **not** removing the catheter within promptly?

33. What do you think the **costs are around removing** the catheter promptly?

Prompts- patient suffering, costs of antibiotics and prolonged hospitalisation

34. Do you think the **benefits** of prompt catheter removal **outweigh the costs**?

35. How would you **feel if you removed** the catheter within 24 hours?

Prompts- good, bad, anxious, confident

36. How would you feel if you **didn't** remove the catheter within 24 hours?

Prompts- good, bad, anxious, confident

37. Does **evidence** suggest removing the catheter promptly is a **good practice**?

Motivation and Goals (intention)

38. How much do you **want to** remove the catheter promptly?

39. How much do you **feel the need to** remove promptly?

40. Are there any **other things** that you **want to do or achieve that interfere** with removing the catheter promptly?

Prompts- your daily work routine, bathing or feeding patients, medicine rounds

41. Which **other things** you do that **helps you** to remove the catheter promptly?

Prompt- which actions?

42. Do your **colleagues agree** with removing the catheter promptly?

43. Do your **colleagues help/facilitate** removing the catheter promptly?

44. Are there any **incentives** to remove the catheter promptly? *Prompt- personal, financial, to patients*

Memory attention and decision processes

45. Is removing the catheter promptly **something you normally do**?

46. How much **attention do you have to pay** when removing the catheter promptly?

47. **Have you forgotten** to remove the catheter promptly?

Prompt- If yes, why did that happen?

48. If you decide **not to** remove the catheter promptly- why would it be?

Prompts- competing tasks, time constraints, change in patient's clinical condition

Environmental context and resources

49. To what extent **physical environment** factors **facilitate** removing the catheter promptly?

50. To what extent **physical environment factors hinder** removing the catheter within 24 hours?

51. To what extent **resource factors facilitate** removing the catheter promptly?

52. To what extent **resource factors hinder** removing the catheter promptly?

53. Are there **competing tasks** and **time constraints**?

54. If so, **what are they**?

55. **How do they affect** catheter removal timing?

56. Are there **necessary resources** available to remove the catheter promptly?

Prompt- different types of resources

Social influences (norms)

57. To what extent do **social influences facilitate** removal of a catheter promptly?

Prompts- peers, managers, mentors, other professional groups, patients, relatives

58. To what extent do **social influences hinder** removal of prompt catheter removal?

Prompts- peers, managers, mentors, other professional groups, patients, relatives

59. How often do you observe others removing the catheter promptly? (i.e. role model)

Behaviour regulation

60. What **preparatory steps** are needed to remove the catheter promptly?

Prompts- individual and organisational

61. What are the **procedures or ways of working** that **encourage** removal of a catheter promptly?

Nature of the behaviours

62. What is the **routine for catheter removal** within 24 hours on your ward?

Prompts- yours and your colleagues routine

63. Who **needs to do what differently** to make sure catheters are removed promptly?

Prompts- when, where, how often and with whom?

64. What do you **currently do to ensure** catheters are removed promptly for patients under your care?

65. Is removing the catheter within 24 hours **a new practice or an existing practice** that **needs to become a habit**?

66. Can there be **something used to prompt the quick catheter removal**?

Prompts- reminders, layout, equipment

67. **How long** do you think removing the catheter promptly is **going to take in practice**?

68. Are there **systems in place for maintaining good practice** of prompt removal of catheter?

69. How would you feel **if patients reminded you on daily basis** whether their catheter is required until it's removed?

Prompts- angry, frustrated, anxious, not in control, patient taking over your authority

70. Would you like to have set guidelines around catheter removal for different procedures where it guides you exactly how many days the catheter should stay in for that particular procedure? E.g. a guideline stating that catheter should be removed 24 hours after child birth or in TURP cases catheter should be removed after 2 days?

Close

Okay, that's all the questions I had for you and thanks for sharing your views.

71. Is there anything that we haven't spoken about in the interview that would like to tell me about prompt removal of catheters?

Okay, we'll leave it there then if that's alright with you

Thank you for your time to participate in the study……

Appendix D: Healthcare professional- recruitment poster for Chapter 4

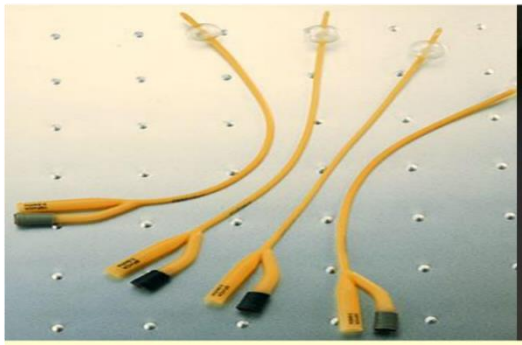
NHS National Institute for Health Research

Newcastle University

The Newcastle upon Tyne Hospitals NHS NHS Foundation Trust

Are you a healthcare professional involved in urinary catheter care and it's removal for patients?

If so, we are interested in your views and catheter experiences



Reducing the Duration of **U**rinary **C**athe**t**ers and Associated Infections (**ReDUCe**) study is exploring views around the factors that promote or delay removal of a urinary catheter before, during or after procedures

To find out how to take part in our study contact:

Rashmi Bhardwaj
Telephone: 0191 2088525
Email: reducestudy@ncl.ac.uk

ReDUCe Study

This study is funded by the National Institute for Health Research
This advertisement has been approved by a Research Ethics Committee
ReDUCe study poster V 1.0 dated 28.10.2013

Appendix E: Healthcare professional- participant information sheet for Chapter 4

Reducing the **D**uration of **U**rinary **C**ath**e**terisation and Associated Infections- ReDUCe study

Healthcare Professional Information Sheet
Version 1.0, Dated 28.10.2013

Invitation

You have been invited to take part in the ReDUCe study which aims to find out your views around catheters.

Before you decide whether or not to take part we would like you to understand why the research is being done and what it would involve for you. Someone from our research team will go through this information sheet with you and answer any questions you have. Talk to your family, friends and colleagues about the study if you wish and please ask us if there is anything that is not clear.

What is the purpose of the study?

We would like to explore the views of a variety of healthcare professionals about factors that encourage or delay catheter removal. Identifying factors that govern the timing of catheter removal will assist in understanding and promoting safe earlier catheter removal, with the aim to help reduce CAUTI in the hospital and community for the benefit of patients.

Why have I been asked to take part?

You have been invited to take part in this study because you are a member of staff who is involved in the removal of urinary catheters from patients under your care in the wards and clinical areas taking part in this research study.

What does taking part involve?

Taking part in this study involves you agreeing to participate in an interview with the study researcher. It is estimated that the interview would take approximately one hour and will be held at a place and time that is convenient to you. During the interview we will ask you questions about your views around factors that promote or delay early catheter removal. Before the interview the researcher will ask you to sign a consent form to take part and to allow us to audiotape the interview which will then be transcribed in anonymised form for analysis after the interview.

Do I have to take part?
No, taking part in the study is voluntary and it is entirely up to you if you want to take part. You can withdraw from the study at any time without giving a reason.

What are the advantages and disadvantages of taking part?

By taking part you have the opportunity to help understand what factors encourage or delay catheter removal which will help in developing new ways of encouraging short catheter duration that are acceptable to patients and healthcare professionals in promoting patient safety and better practice.

During the interview there is the possibility that some participants may raise sensitive and possibly upsetting issues relating to their personal experience in hospital. We are also conscious of the time involved in taking part. We will be sensitive to these issues.

Will taking part in the project be kept confidential?

All information about you and anything that you tell us will be handled confidentially and will be stored on at the Institute of Health & Society, Newcastle University. However should there be matters that you want to talk about that suggests malpractice or misconduct by healthcare staff we may need to report this to the appropriate manager to be dealt with according to the hospital policy. You will not be identifiable in any written reports or publications that arise from this study.

What happens next?

If you are interested in taking part, please inform the named researcher Rashmi Bhardwaj on **0191 2228525** or email reducestudy@ncl.ac.uk or by returning reply form (at the end of this document) in the self-addressed envelope provided. The study researcher will arrange to meet with you during your working hours to discuss the study, to answer any questions you may have. If you are still interested to take part, researcher will consent you to participate and arrange a suitable time for your interview.

Who is organising and funding the research?

This research is funded by the National Institute for Health Research and sponsored by The Newcastle upon Tyne Hospitals NHS Foundation Trust.

Who has reviewed the project?

All research in the NHS is looked at by an independent Research Ethics Committee, to protect your interests. This project has been reviewed and given a favourable opinion by both the Newcastle & North Tyneside Ethics Committee and Research Governance Committee at The Newcastle upon Tyne Hospitals NHS Foundation Trust.

Where can I get further information about this study?

If you have any concerns or would like to discuss any aspect of taking part in this study you can contact:
Rashmi Bhardwaj, Research Fellow/Senior Research Nurse
Tel: **0191 2228525** **Email:** reducestudy@ncl.ac.uk

Address: Institute of Health & Society, Newcastle University Baddiley-Clark Building, Richardson Road, Newcastle upon Tyne, NE2 4AX

Thank you for taking the time to read this information.

Expression of Interest/Reply Form

Please initial boxes

1. I confirm that I have read and understand the information sheet Version 1.0, dated 28.10.2013 and I am interested in being contacted about participating in the study. ☐

2. I have read and understand the information sheet Version 1.0, dated 28.10.2013 and I am NOT interested in being contacted about participating in the study. ☐

Please proceed to points 3 and 4 only if you are interested in taking part.

3. If you are interested in taking part please give your preferred method for the researcher to contact you:

Telephone number: _____

E mail address: _____

4. Please give the days and times in the week when it would be most convenient to you for the researcher to get in touch during your working hours:

_____

_____

_____	_____	_____
Name	Date	Signature

Appendix F: Healthcare professional- consent form for Chapter 4

The Newcastle upon Tyne Hospitals NHS
NHS Foundation Trust

Reducing the **D**uration of **U**rinary **C**ath**e**terisation and Associated Infections- ReDUCe study

Healthcare Professional Participants- Consent Form
Version 1.0, Dated 28.10.2013
Site: The Newcastle upon Tyne Hospitals NHS Foundation Trust
Participant Initials:
Participant Study Number:
Participant Ward/Clinical Area:
Name of Researcher: Rashmi Bhardwaj
Supervisors: Dr Justin Presseau; Professor Rob Pickard; Dr Debbie Carrick-Sen

	Please provide your initials in the box
1. I confirm that I have read and understand the information sheet dated 28.10.2013 (version 1.0) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without my employment or legal rights being affected.	
3. I understand that all data collected during the interview will remain anonymous and confidential, and will be stored in a locked filing cabinet (paper copies) and on password protected computers (electronic copies) located in the Institute of Health and Society at Newcastle University.	
4. I agree to allow the researchers to audio-record the interview. I understand that direct quotes may be used in the final report or scientific publications, however these will be anonymised and no personal information which could identify me will be used.	
5. I agree that anonymous data may be used for future projects.	
6. I agree to take part in the above study in the interview study.	

_____ _____ _____

Name of Patient Date Signature

_____ _____ _____

Researcher Date Signature

When completed, 1 copy for participant; 1 for researcher site file

Appendix G: Healthcare professional- double coding summary for Chapter 4

Domain	Total codes	Agreement	Disagreement	Suggestion to double code (DC)	Summary
Knowledge (D01)	66	64	2	0	1 code to be moved to Nature of the Behaviours 1 code to be moved to Skills
Skills (D02)	37	35	2	0	1 code to be moved to Beliefs about Capabilities 1 code to be moved to Nature of the Behaviours
Social professional role and identity (D03)	36	36	0	0	Full agreement
Beliefs about capabilities (D04)	80	68	12	0	2 codes to move over to Behaviour regulation 1 codes to be moved to Beliefs about Consequences 1 codes to be moved to Motivation and Goals 4 codes to be moved to Decision making 1 code to move over to knowledge 1 codes to move over to memory attention and decision making 1 code to move over to Social Influences 1 code to move over to Skills
Beliefs about consequences (D05)	96	87	9	1	1 code to move over to nature of the behaviours 1 code to move over to Social Influences 1 code to move over to knowledge 2 codes to move over to memory attention and decision making 1 code to be moved to SI, team working – communication

					1 code to be moved to SI- knowledge & awareness of others 1 code to be moved over to SI- group norms 1 code to be moved over to SI, social pressure, age related factors 1 code to be DC in current domain and emotion
Motivation and goals (D06)	33	31	2	0	2 codes to be moved to Social Influences
Memory, attention and decision processes (D07)	50	49	1	2	1 code to be moved over to nature of the behaviours 1 code to DC in current domain & Emotion 1 code to DC in current domain & beliefs about capabilities, perceived behaviour control 1 code to DC in Social Influences, conflict-competing demands
Environmental context and resources (D08)	73	63	10	2	5 codes to be moved to Nature of the Behaviours 4 codes to be moved to Beliefs about Consequences 1 code to DC in Nature of the Behaviours 1 code to DC in Beliefs about Consequences
Social Influences (D09)	94	90	4	1	Disagreement on 4 codes. These codes got moved to *Nature of the Behaviours* & *Skills (Interpersonal)* Suggestion to DC 1 code in *Social Influences* & *Nature of the Behaviours* Domain
Emotion (D10)	27	27	0	0	Full agreement

Behaviour regulation (D11)	80	67	13	1	1 code to be moved to motivation 1 codes to be moved to Beliefs about Consequences 3 codes to be moved to Social Influences 2 codes to be moved to Decision making 1 codes to be moved to Nature of the Behaviours (direct behaviour) 2 codes to DC in Social Influences 1 codes to be moved to Nature of the Behaviours (Habit) 1 code to be moved to Beliefs about Capabilities (professional competence) 1 code to be moved to Knowledge
Nature of the behaviours (D12)	50	46	4	2	Disagreement on 4 codes, which were moved to suggested domains 2 codes were suggested to be DC

Appendix H: Patient- interview schedule for Chapter 5

The following information to be collected from medical, nursing and catheter care records before the interview.

General demographics

Age	
Gender	
Speciality	
Date of hospital admission	
Reason for hospital admission	
Elective/acute admission	

Catheter information from catheter care record

Date of insertion	
Reason for insertion	
Place of catheter insertion (e.g. ward, theatre)	
Patient under anaesthetic at time of catheter insertion?	

Format

- Greeting & thank you for agreeing to be interviewed for this study
- Recording of interviews for transcription - assurances of anonymity and confidentiality
- The interview will take around 1 hour
- Can stop at any time you wish
- The interview will explore your views around urinary catheters and its duration to help us understand how best to reduce the length of unnecessary prolonged catheterisation in practice
- There are no right or wrong views - we are interested in hearing all perspectives
- Any questions or concerns
- Close interview

Introduction: Thank you for agreeing to participate in this interview. The aim of the study is to help us understand more about urinary catheters and its duration. We are interested in your views around catheterisation but specifically for how long the catheter stays in for.

Start recording from this point on…

1. Have you had any experience with a catheter in the past (via a family member or yourself)?
   Prompt- strategy for keeping patient focused on the topic

2. I gather from your notes that you have had a urinary catheter put in due to xxx procedure.

   a) What information did you receive about your catheter before your procedure
   Prompts- who? What? When? How? Since then?

Introduction to next topic – Thanks for answering these questions. In the next section I am specifically interested in how people like you, communicate with rest of the team.

3. How do you feel about asking staff whether your catheter is still needed?
   Prompt- do you feel the same way asking this question to all of the staff members? e.g. nurse, doctor, support worker etc.

4. How do you feel about doing it within 24 hours? (if applicable)

5. How do you feel about doing it on daily basis until the catheter comes out?

6. Would asking this question on daily basis ever slip your mind?

7. Are there ever situations in which you get distracted from that prevent you to ask these questions?
   Prompts- something more important comes up, interruptions from other patients, family members or staff

8. How important is it to you to ask staff for timely removal of your catheter?
   Prompt- Considering the benefits of prompt removal, How much do you want to do it? Are you compelled to do it? Is there anything more important? Why?

9. Have you ever prompted or reminded a staff member responsible for your care in current or any other situation?
   Prompt- for example, asking staff to wash their hands before they deliver care to you (if you haven't seen them do it)

Introduction to next topic – Now we are going to move on to the environmental factors that in your opinion may or may not contribute to early or late catheter removal.

10. How far is the toilet from your bedside?
    Prompt- Interviewer to make note of the walkable distance from patient's bedside to the toilet

11. How long does it take for you to walk to the nearest toilet?
    Prompt- Interviewer to make a note of patient's time taken to walk to the toilet- consider elderly frail vs fit and young patients, type of procedure, number of post-procedural days

12. Do you think the toilet is located within a reasonable distance for you to walk to it?
    Prompts- is it at convenient distance? Is it too far? If too far, would it stop you from having your catheter removed early?

13. If you are not capable of walking to the toilet within 24 hours of your procedure- would you consider using alternative methods?
    Prompt- e.g. use of bed pan or commode

14. Anything else you would like to mention under environmental impact on catheter duration?

Introduction to next topic – Now let's talk about how other people may help or stop you from asking staff questions about if the catheter is still needed.

15. Are there any influential individuals or groups who are in favour of patients asking staff whether a catheter is still needed on daily basis?
    Prompt- staff members, friends, family, yourself

16. Are there any influential individuals or groups who are in favour of patients asking staff whether a catheter is still needed on daily basis?
    Prompt- staff members, friends, family, yourself

17. Do you consider their opinion when asking staff these questions?
    Prompt- do their opinion cross your mind at all?

18. Do you think about opinion of these influential people when you consider asking staff questions?
    Prompt- if you got the sense that others didn't approve of you asking staff questions, would that influence whether or how you would ask questions?

Introduction to next topic – Now in the last section we are going to talk about advantages and disadvantages of early and late catheter removal and its consequences.

19. Do you know if there are any side-effects of delayed catheter removed?
    Prompts- e.g. increased infection risk, increased number of hospitalised days

20. What are the costs of catheter infections to patients and healthcare?
    Prompt- to patients- additional suffering to patients from catheter infections
    To healthcare system- cost to treat catheter related infections and cost of prolonged hospital stay as a result

21. Are there any benefits of prolonged catheter duration?
    Prompt- patient not wanting to mobilise (walk to the toilet or use alternative methods) post procedure due to pain factors

22. Do you think that benefits of using catheter for longer outweigh patient suffering and costs?

In conclusion

That’s all the questions I have for you. Is there anything else that we haven’t discussed, relevant to this topic that you would like to add?

Thank you for your time to participate in the study.

Appendix I: Patient- recruitment poster for Chapter 5

NHS National Institute for Health Research

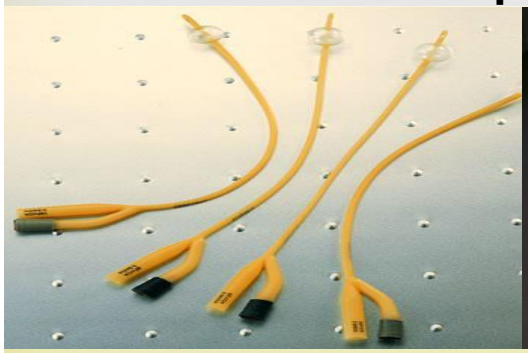
Newcastle University

The Newcastle upon Tyne Hospitals NHS
NHS Foundation Trust

Have you recently had a urinary catheter?

Will you need a urinary catheter during your hospital stay?

If so, we are interested in your views and catheter experiences



Reducing the Duration of **U**rinary **C**ath**e**ters and Associated Infections (**ReDUCe**) study is exploring views around the factors that promote or delay removal of a urinary catheter before, during or after procedures

To find out how to take part in our study contact:

Rashmi Bhardwaj

Telephone: 0191 2448357 or 2228525

Email: rashmi.bhardwaj1@ncl.ac.uk

ReDUCe Study

Study is funded by the National Institute of Health Research

This advertisement has been approved by a Research Ethics Committee

ReDUCe study poster V 1.0 dated 28.10.2013

Appendix J: Patient- participant information sheet for Chapter 5

The Newcastle upon Tyne Hospitals NHS
NHS Foundation Trust

Reducing the **D**uration of **U**rinary **C**ath**e**terisation and Associated Infections- ReDUCe study

Patient Information Sheet – Interviews
Version 1.0, Dated 28.10.2013

Invitation

You have been invited to take part in a research study that is interested in your views about catheters. Before you decide whether or not to take part we would like you to understand why the research is being done and what it would involve for you. Someone from our research team will go through this information sheet with you and answer any questions you have. Talk to your family, friends, other patients, or your doctors and nurses about the study if you wish and please ask us if there is anything that is not clear.

What is the purpose of the study?

The purpose of this study is to find out patients' views and beliefs around the length of time urinary catheters should be used after medical procedures. We want to find out how patients can contribute to the drive to reduce the length of urinary catheters. This is important because urinary catheters that are left in too long can cause urinary infections which are uncomfortable, need antibiotics and may delay discharge from hospital.

In this study we are interviewing people like you to get a broad idea of the different things that patients feel and believe about urinary catheterisation. This will help us to discover the most important things from your point of view that are likely to encourage or delay catheter removal.

Why have I been asked to take part?

You have been invited to take part in this study because you had a urinary catheter put in as part of your hospital care.

What does taking part involve?

Taking part in this study involves you agreeing to be interviewed by the researcher. Each interview will be conducted by the lead study researcher after you have your catheter in place, will take around 1 hour and will be held in the hospital at a place and time that is convenient to you.

During the interview we will ask questions to find out about your views around things that encourage or delay early catheter removal. Before the interview the researcher will ask you to sign a consent form to take part and to allow us to audiotape the interview which will be written out later in an anonymised form for analysis.

Do I have to take part?
No, taking part in the study is voluntary and it is entirely up to you if you want to take part. You can withdraw at any time without giving a reason.

What are the advantages and disadvantages of taking part?
By taking part you have the opportunity to help us to understand what encourages or delays catheter removal which will help us to develop new ways of encouraging a short duration of catheterisation that are acceptable to both patients and healthcare professionals. This will help make hospital care safer.

During the interview there is the possibility that some participants may raise sensitive and possibly upsetting issues relating to their personal experience in hospital. We are also conscious of the time involved in taking part. We will be sensitive to these issues.

Will taking part in the project be kept confidential?
All information about you and anything that you tell us will be handled confidentially and stored at the Institute of Health & Society, Newcastle University. However should there be matters that you want to talk about that suggests malpractice or misconduct by healthcare staff we may need to report this to the appropriate manager to be dealt with according to the hospital policy. You will not be identifiable in any written reports or publications that arise from this study.

What happens next?
If you are interested in taking part, please inform the named researcher Rashmi Bhardwaj on **0191 2088525** or email reducestudy@ncl.ac.uk or by returning reply form (at the end of this document) in the self-addressed envelope provided. The study researcher will arrange to meet with you during your hospital visit to discuss the study in more detail, to answer any questions you may have. If you are still interested to take part, researcher will consent you to participate and arrange a suitable time for your interview.

What if there is a problem?
If you have a concern about any aspect of this study, you should speak to the lead researcher Rashmi Bhardwaj who is in-charge of this aspect of the study and will do her best to answer your questions (available on 01912088525 or email: reducestudy@ncl.ac.uk). If you remain unhappy and wish to complain formally, you can do this through the National Health Service complaints procedure. Details can be obtained from the Patient Advice and Liaison Service (PALS http://www.pals.nhs.uk/) at your local hospital.

In the very unlikely event of something going wrong and you are harmed during the research and this is due to someone's negligence then you may have grounds for legal action for compensation against the NHS Trust that treated you or the study sponsor organisation Newcastle upon Tyne Hospitals NHS Foundation Trust, but you may have to pay your legal costs. The normal NHS complaints mechanisms will always be available to you.

Who is organising and funding the research?
This research is funded by the National Institute for Health Research and sponsored by The Newcastle upon Tyne Hospitals NHS Foundation Trust.

Who has reviewed the project?
All research in the NHS is looked at by an independent Research Ethics Committee, to protect your interests. This project has been reviewed and given a favourable opinion by both the Newcastle & North Tyneside Ethics Committee and Research Governance Committee at The Newcastle upon Tyne Hospitals NHS Foundation Trust.

Where can I get further information about this study?

If you have any concerns or would like to discuss any aspect of taking part in this study you can contact:

Rashmi Bhardwaj, Research Fellow/Senior Research Nurse
Tel: 01912088525 **Email:** reducestudy@ncl.ac.uk

Address: Institute of Health & Society, Newcastle University Baddiley-Clark Building, Richardson Road, Newcastle upon Tyne, NE2 4AX

Alternatively, for independent advice you can contact Mr Chris Harding (Consultant Urologist) on 0191 2137321 or you can discuss the study with your GP and family members.

Thank you for taking the time to read this information.

Expression of Interest/Reply Form

Please initial boxes

4. I confirm that I have read and understand the information sheet Version 1.0, dated 28.10.2013 and I am interested in being contacted about participating in the study. ☐

5. I have read and understand the information sheet Version 1.0, dated 28.10.2013 and I am NOT interested in being contacted about participating in the study. ☐

Please proceed to points 3 and 4 only if you are interested in taking part.

3. If you are interested in taking part please give your preferred method for the researcher to contact you:

Telephone number: _____

E mail address: _____

4. Please give the days and times in the week when it would be most convenient to you for the researcher to get in touch

_____

_____ _____ _____
Name Date Signature

Appendix K: Patient- participant consent form for Chapter 5

The Newcastle upon Tyne Hospitals NHS
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Reducing the **D**uration of **U**rinary **C**ath**e**terisation and Associated Infections- ReDUCe study

Patient Participants – Interview Consent Form

Version 1.0, Dated 28.10.2013

Site: The Newcastle upon Tyne Hospitals NHS Foundation Trust
Participant Initials:
Participant Study Number:
Participant Ward/Clinical Area:
Name of Researcher(s): Rashmi Bhardwaj
Supervisors: Dr Justin Presseau; Professor Rob Pickard; Dr Debbie Carrick-Sen

Please initial each box

1. I confirm that I have read and understand the information sheet dated 28.10.2013 (version 1.0) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without my medical care or legal rights being affected.	
3. I understand that sections of any of my medical notes may be looked at by responsible individuals directly involved in this study or from regulatory authorities where it is relevant to my taking part in research. I give permission for these individuals to have access to my records.	
4. I understand that all data collected during the interview will remain anonymous and confidential, and will be stored in a locked filing cabinet (paper copies) and on password protected computers (electronic copies) located in the Institute of Health and Society at Newcastle University.	
5. I agree to allow the researchers to audio-record the interview. I understand that direct quotes may be used in the final report or scientific publications, however these will be anonymised and no personal information which could identify me will be used.	
I agree that anonymous data may be used for future projects.	
7. I agree to take part in the above interview study.	

Name of Patient	Date	Signature
Researcher	Date	Signature

When completed, 1 copy for participant; 1 for researcher site file; 1 copy for medical notes

Appendix L: Patient- double coding summary for Chapter 5

Domain number	Domain name	Total codes	Agreement	Disagreement	Suggestion to double code (DC)	Code consensus summary
D01	Knowledge	86	80	6	0	2 code moved over to D3 2 codes moved over to D4 1 code moved over to D5 1 code moved over to D6
D02	Skills	30	13	17	3	5 codes moved to D3 9 codes moved to D4 3 codes double coded to D2 and D4
D03	Social professional role and identity	68	65	3	0	1 code moved to D7 2 codes moved to D11
D04	Beliefs about capabilities	97	89	8	1	1 code moved to D2 3 codes moved to D3 1 code moved to D9 2 codes moved to D11 1 code moved to D12 1 code double coded to D4 and D11
D05	Beliefs about consequences	142	109	33	0	2 codes moved to D1 3 codes moved to D3 2 codes moved to D4 2 codes moved to D6 4 codes moved to D7 11 codes moved to D9 3 codes moved to D11 6 codes moved to D1
D06	Motivation and goals	41	36	5	0	1 code moved to D4 3 codes moved to D9

						1 code moved to D12
D07	Memory, attention and decision processes	31	29	2	0	1 code moved to D9 1 code moved to D10
D08	Environmental context and resources	65	54	11	0	1 code moved to D3 3 codes moved to D4 4 codes moved to D9 3 codes moved to D11
D09	Social Influences	122	102	20	0	3 codes moved to D3 3 codes moved to D4 1 code moved to D7 6 codes moved to D8 5 codes moved to D11 2 codes moved to D12
D10	Emotion	14	12	2	0	1 code moved to D3 1 code moved to D5
D11	Behaviour regulation	13	9	4	0	3 codes moved to D9 1 code moved to D10
D12	Nature of the behaviour	10	4	6	1	2 codes moved to D4 3 codes moved to D9 1 code double coded to D4 and D10

Appendix M: HOUDINI catheter care plan for Chapter 6

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Care Plan for Urethral Catheter (Adult)

Affix patient identification label in box below or complete details

Surname	Patient I.D. No.
Forename	D.O.B. / /
Address	NHS No.
Postcode	

To be completed by staff caring for a patient with a urethral catheter

Site: _____ Ward: _____

1	Patient's informed consent must be obtained prior to the insertion and care of a urethral catheter. Ensure that patient's privacy and dignity is maintained at all times.
2a	Urethral catheter insertion must be undertaken by a registered and competent healthcare professional using an aseptic non touch technique (ANTT) and wearing the appropriate personal protective equipment (gloves/apron/visor).
2b	The catheter insertion record must be completed.
3	Use ANTT and refer to Trust policies relating to asepsis procedures when caring for the catheter and drainage equipment.
4a	Clean at catheter entry site minimum of once per day using a cleansing solution.
4b	In male patients with urethral catheter ensure the foreskin is repositioned after cleansing.
5	**Post- operative surgical patients – urethral catheter should be considered for removal 24-48hrs post operation unless HOUDINI applies.**
6	Check catheter every 4 hours for patency. Empty drainage bag when 3/4 full or otherwise indicated.
7	Observe colour, clarity and odour of the urine and report any abnormalities.
8	Observe patient for any pain, increased confusion or pyrexia and report any abnormalities or unusual behaviour.
9a	A sterile leg bag should be used and supported by appropriate catheter equipment.
9b	The position of the drainage bag must be below bladder level and above the floor.
10	If appropriate, use catheter drainage bag equipment including catheter fixation device, drainage bag sleeves and straps in order to provide support to the system.
11a	Change the leg drainage bag weekly, recording date of change on the bag. If a catheter valve is used, then change every 7 days or according to manufacturer's instructions.
11b	If the leg bag becomes damaged or disconnected from the catheter, replace and document in the patient's records.
12	At night, connect a non-sterile single use overnight 2 litre drainage bag to the leg drainage bag system. If using a catheter valve connect this to a sterile single use night drainage bag. The overnight drainage bag must be removed on patient wakening.
13	Change the urethral catheter in accordance with manufacturer's recommendations that is short-medium term catheters up to 28 days and long term catheters up to 12 weeks.
14	Patients with a long term catheter, record catheter history and report any complications with the catheter in the patient's records.
15	Provide patient/parent/carer with information on care of the catheter and drainage system.
16a	If the patient is to be discharged with a urethral catheter in situ, provide patient/parent/carer with 'Hospital to Home' discharge catheter pack, a spare urinary catheter, any other appropriate equipment, patient instruction leaflet/catheter passport.
16b	Inform the relevant body e.g. District Nurse/ Care Home/ Hospice.
17	If the catheter is removed, complete relevant section on the Care Pathway for Urethral Catheter.

Reason for urinary catheter insertion using HOUDINI framework (please tick):
- ❑ **H**aematuria (specific clinical indication only including blood clots in urine)
- ❑ **O**utflow obstruction
- ❑ **U**rology/surgery
- ❑ **D**amage to skin (grade III or IV pressure ulcers or other severe skin damage)
- ❑ **I**ntake and Output Monitoring (accurate measurement of urinary output)
- ❑ **N**ursing – end of life care
- ❑ **I**mmobility due to physical constraints
- ❑ Other state: .....

Urethral catheter date inserted:

Time inserted:

Inserted by & Designation: (Print name)

Patient verbal /written consent: YES/NO	Urine drained/aspirated before the balloon has been inflated: YES/NO	Complete and insert catheter pack sticker here including date for removal:
Latest date for removal of urinary catheter:	Amount of urine drained on insertion:	
Lubricant Used: YES/NO Expiry Date: Prescribed: YES/NO Dose given: Batch Number:	Any difficulties encountered during insertion: YES/NO Record information here	

An indwelling urethral catheter significantly increases the risk of a patient developing a catheter-associated UTI (CAUTI)

*** YOU must ASSESS and RECORD the clinical REASON why the catheter remains in situ EVERYDAY***

Circle the HOUDINI letter to indicate reason for urinary catheter remaining in situ and sign that Care Pathway has been adhered to

REMOVE CATHETER WHEN NO LONGER CLINICALLY INDICATED				LATEST REMOVAL DATE		
Date / Time		Reason Catheter remains (circle)	Reason Catheter remains (circle)	Signature	Print Name	Job Title
1		HOUDINI	O			
2		HOUDINI	O			
Post- operative surgical patients – urethral catheter should be reviewed for removal 24-48hrs post operatively						
3		HOUDINI	O			
4		HOUDINI	O			
5		HOUDINI	O			
6		HOUDINI	O			
7		HOUDINI	O			
8		HOUDINI	O			
9		HOUDINI	O			
10		HOUDINI	O			
11		HOUDINI	O			
12		HOUDINI	O			
13		HOUDINI	O			
14		HOUDINI	O			
15		HOUDINI	O			
16		HOUDINI	O			
17		HOUDINI	O			
18		HOUDINI	O			
19		HOUDINI	O			
20		HOUDINI	O			
21		HOUDINI	O			
22		HOUDINI	O			
23		HOUDINI	O			
24		HOUDINI	O			
25		HOUDINI	O			
26		HOUDINI	O			
27		HOUDINI	O			
28		HOUDINI	O			

For patients who care for their own urethral catheter read the following and if appropriate sign below:

Patient cares for their own urinary catheter, has up to date knowledge as to how to care for their urethral catheter correctly

Patient is aware to ask for any assistance if required

Review weekly or as appropriate and document in patient's notes

Date and time:

Signature:

URETHRAL CATHETER REMOVAL/TRIAL WITHOUT CATHETER

Print name and designation:		Document any complications encountered upon removal.
Signature:		
Date:		

GUIDANCE POST REMOVAL OF URETHRAL CATHETER

1. Assess for voiding.
2. Offer assistance to access toilet 2-3 hourly, record intake and output on a fluid balance chart.
3. If patient has not voided within 4-5 hours, pre and post void bladder scan.

Bladder scanner available:

1. If residual is **<200ml**: document in patient notes and reassess in 2 hours.
2. If residual is **>200mls, but <300mls** and patient is not uncomfortable: document and re-assess 2 hours later.
3. If residual is **>300mls**: discuss with medical staff, document treatment plan and consider in-out catheterisation, recording volume.
4. Repeat process after 4-5 hours if necessary and document.

No bladder scanner available in unit:
Competent Medical/ Nursing staff to palpate bladder for distension, assess patient's comfort level and condition, discuss with medical staff whether in-out urinary catheterisation would be beneficial.

If problems with incontinence please refer to Care Pathways for bladder & bowel care and follow Skin Care Guidelines. Refer to Trust intranet.

Urethral Catheter Observation Chart

Site: _____ Ward: _____

Date / /	AM	PM	NIGHT
Hand hygiene performed before/after catheter contact	Y/N	Y/N	Y/N
Catheter hygiene maintained (minimum once daily)	Y/N	Y/N	Y/N
Any signs of infection?	Y/N	Y/N	Y/N
Position of drainage bag appropriate	Y/N	Y/N	Y/N
Bag change (if applicable)	Y/N	Y/N	Y/N
Catheter removed	Y/N	Y/N	Y/N
New catheter inserted	Y/N	Y/N	Y/N
Initials			

Date / /	AM	PM	NIGHT
Hand hygiene performed before/after catheter contact	Y/N	Y/N	Y/N
Catheter hygiene maintained (minimum once daily)	Y/N	Y/N	Y/N
Any signs of infection?	Y/N	Y/N	Y/N
Position of drainage bag appropriate	Y/N	Y/N	Y/N
Bag change (if applicable)	Y/N	Y/N	Y/N
Catheter removed	Y/N	Y/N	Y/N
New catheter inserted	Y/N	Y/N	Y/N
Initials			

Date / /	AM	PM	NIGHT
Hand hygiene performed before/after catheter contact	Y/N	Y/N	Y/N
Catheter hygiene maintained (minimum once daily)	Y/N	Y/N	Y/N
Any signs of infection?	Y/N	Y/N	Y/N
Position of drainage bag appropriate	Y/N	Y/N	Y/N
Bag change (if applicable)	Y/N	Y/N	Y/N
Catheter removed	Y/N	Y/N	Y/N
New catheter inserted	Y/N	Y/N	Y/N
Initials			

Date / /	AM	PM	NIGHT
Hand hygiene performed before/after catheter contact	Y/N	Y/N	Y/N
Catheter hygiene maintained (minimum once daily)	Y/N	Y/N	Y/N
Any signs of infection?	Y/N	Y/N	Y/N
Position of drainage bag appropriate	Y/N	Y/N	Y/N
Bag change (if applicable)	Y/N	Y/N	Y/N
Catheter removed	Y/N	Y/N	Y/N
New catheter inserted	Y/N	Y/N	Y/N
Initials			

Date / /	AM	PM	NIGHT
Hand hygiene performed before/after catheter contact	Y/N	Y/N	Y/N
Catheter hygiene maintained (minimum once daily)	Y/N	Y/N	Y/N
Any signs of infection?	Y/N	Y/N	Y/N
Position of drainage bag appropriate	Y/N	Y/N	Y/N
Bag change (if applicable)	Y/N	Y/N	Y/N
Catheter removed	Y/N	Y/N	Y/N
New catheter inserted	Y/N	Y/N	Y/N
Initials			

Date / /	AM	PM	NIGHT
Hand hygiene performed before/after catheter contact	Y/N	Y/N	Y/N
Catheter hygiene maintained (minimum once daily)	Y/N	Y/N	Y/N
Any signs of infection?	Y/N	Y/N	Y/N
Position of drainage bag appropriate	Y/N	Y/N	Y/N
Bag change (if applicable)	Y/N	Y/N	Y/N
Catheter removed	Y/N	Y/N	Y/N
New catheter inserted	Y/N	Y/N	Y/N
Initials			

For patients who are self caring for urethral catheter

Please read the following and if appropriate sign the box below.
Patient is self- caring with urinary catheter, has up to date knowledge on how to care for urinary catheter correctly.
Patient aware to ask for any assistance if required
Review weekly or as appropriate and document in patient records.

Date and time:

Signature:

Name

Adapted from HOUDINI Nurse led protocol

Produced by Catheter Care Sub-Group, Clinical educators and Infection Prevention and Control

Review Date: March 2020

Point Print (UK) Nov 2013

NU111201

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